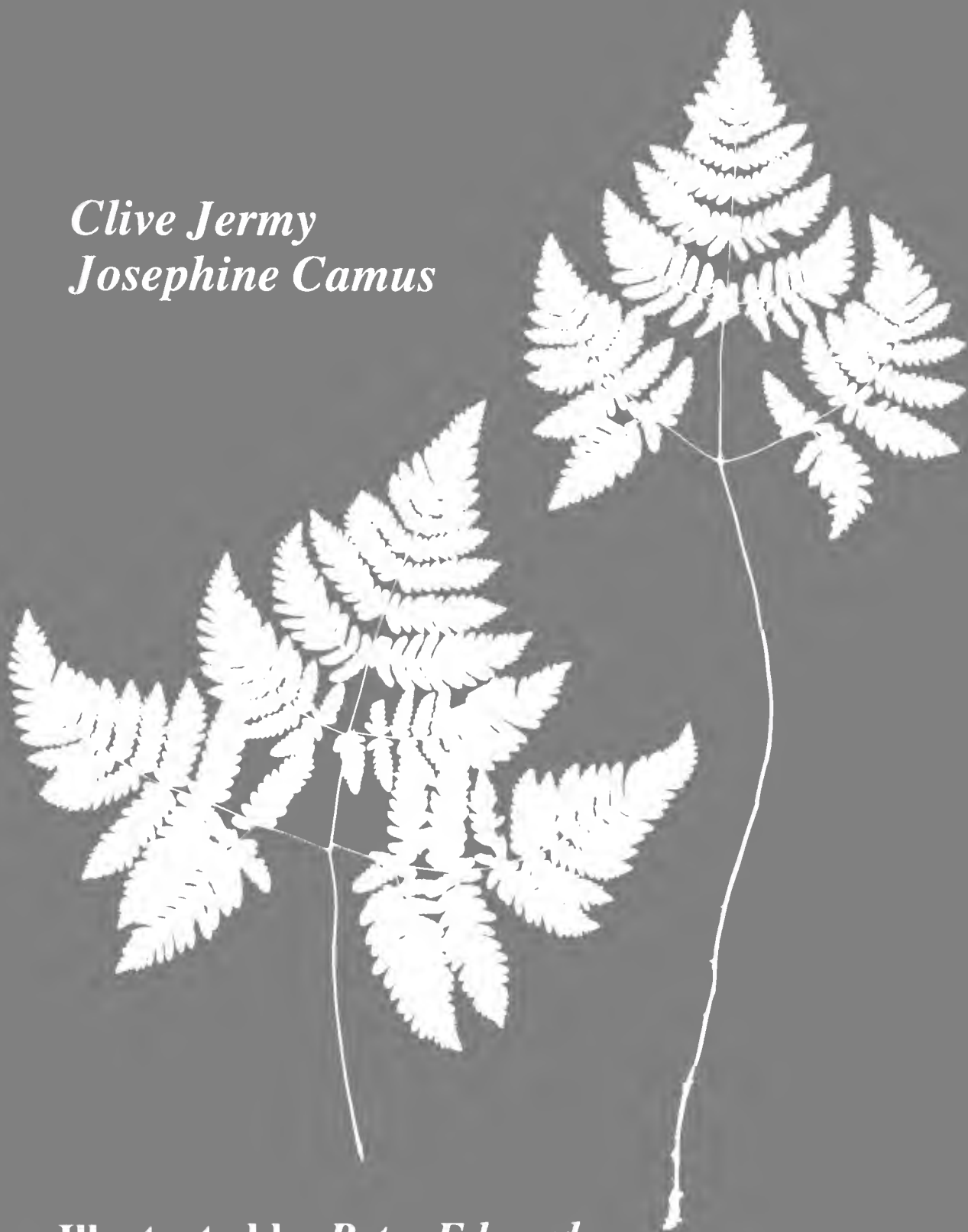


The Illustrated Field Guide to Ferns and Allied Plants of the British Isles

Clive Jermy
Josephine Camus



Illustrated by *Peter Edwards*

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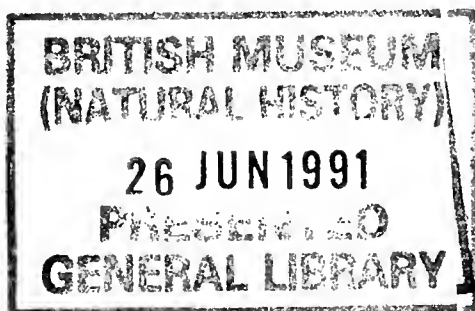
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London

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Authors' preface

A few years ago we produced a booklet called the *BM Fern Crib* and comments from its users showed that a diagnostic guide to all ferns (and allies) would be welcomed by those botanists and other naturalists who still found aspects of the group difficult. At the same time, we hope to encourage those who are curious about ferns to get to know the group. We believed that illustrations would be crucial to such a guide and we were fortunate that Peter Edwards joined us in its production. Derek Adams, of the Museum's Photographic Unit, expertly prepared the silhouettes. We gratefully acknowledge permission to use the figures of spores of *Isoetes* and *Cystopteris* from *Flora Iberica* (C.S.I.C., Madrid, 1986).

Over the years we have enjoyed the stimulating companionship of many friends in the British Pteridological Society and the Botanical Society of the British Isles, both in the field and the herbarium. We thank them all. In particular we thank Anthony Pigott and Christopher Fraser-Jenkins for their help with *Dryopteris affinis*. We are particularly grateful to Christopher Page, not only for help with bracken and for providing the silhouettes of that species, but also for sharing his knowledge of ferns on many field trips.

We owe special thanks to our colleague in the Fern Herbarium, Alison Paul, who has taken the role of Editor of this book. Her thoroughness has enhanced the book considerably. Any mistakes that now remain are, however, ours and not hers.

C.J. and J.C.

The Natural History Museum, London. March, 1991

How to use this book

This book aims to provide a tool for the amateur botanist, naturalist or other interested person who wants to name a fern, horsetail or clubmoss found wild in Britain or Ireland. Silhouettes and detailed drawings are annotated to guide the reader to the distinguishing features of each species, and, as a result, detailed written descriptions and comparisons are kept to a minimum. Diagnostic features are printed in bold. For those who want to delve further, or who want to compare the detailed structure and distribution of these pteridophytes, there are more comprehensive books available. A selection of these is given in the *Bibliography*.

The user should remember that plants react to their environment as they grow and the first leaves to unfurl at the beginning of the growing season will typically be different from those produced later; the former are usually sterile, never bearing spores. Very young plants (called *sporelings*) of many fern species produce leaves that are not at all like those of the older plant - just like seedlings of flowering plants. These are often impossible to identify to species. Furthermore, the leaves of somewhat older, but still immature, plants may be different to those of more mature ones. This is particularly the case in ferns, where the production of fertile sporing leaves is no true indication of age or maturity of form. Like most organisms, ferns have in-built genetic variation as well, so that two plants of the same species growing side-by-side may not look like carbon-copies. Those users of this book who are already experienced field botanists will be able to assess the variation acceptable within a species. Less experienced people will need time to gauge such aspects.

The 'dichotomous key' leads to a species, genus or group; more detailed keys are given in the appropriate section. Less experienced users may prefer to flip through the book until they find a drawing that looks something like the plant in front of them and then see how well the two match up. If the match is not a good one, the 'Compare with' section on the page will lead to alternatives to try for a better match.

Whilst we have emphasised vegetative characters throughout, to be certain of an identification we often have to look at critical features of the sori, sporangia and spores. Because of this late summer is the best time for studying most ferns. Exceptions include the adder's tongues, the land quillwort and some horsetails.

How to use this book (*continued*)

Measurements of pinnae refer to the longest ones. Where a range of measurements is given this is for the mature adult plant; in many cases we give a maximum size only and young plants with smaller (and fertile) leaves may well be found. A hand-lens with a x 10 magnification is needed as some of the characteristics described are too small to be seen with the naked eye. Sometimes a higher magnification: x 20 hand-lens, a dissecting microscope (x 50), or a compound microscope (x 400) may be necessary.

Seventy-two species of pteridophyte (numbered 1-72), native or well-established in the British Isles, are described in this book. The arrangement and nomenclature follows that used in the herbarium of the Natural History Museum, London (BM). Intraspecific variation is described where appropriate at either the subspecies or variety level. In those few groups where taxonomic units are recognisable but their rank and names are not certain, we have used the *non-hierarchical* category '*morphotype*' without implying rank or legality.

Where appropriate, we have drawn attention in the text to the presence of hybrids in our fern flora; they are sometimes more common than generally supposed, and *may* be the reason a specimen does not match our descriptions. Hybrids are usually morphologically intermediate between the parents, and can be detected - and should always be confirmed - by the presence of mostly shrivelled spores in their sporangia (seen with a x 100, or better still, with a x 400 compound microscope). Apogamous ferns also have some abortive spores (see p 156).

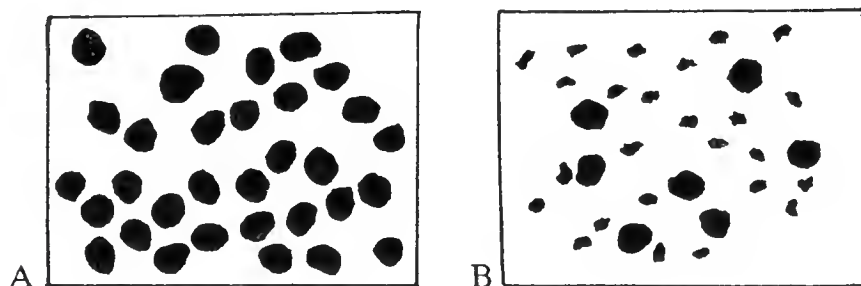


Figure 1. Contents of A, a normal sporangium; B, a hybrid sporangium

We have added six alien ferns at the end of the book in an abbreviated format. These are species which have occurred in more than one isolated site, and which might be confused with our native species. As with all plant groups grown in gardens or greenhouses, from time to time there will be occasional escapes. These are discussed briefly on p 186.

Introduction to ferns and allied plants

Ferns are traditionally grouped with the clubmosses, spikemosses, quillworts and horsetails as *pteridophytes* because, like flowering plants, they have a vascular system of specialised cells which conducts water and nutrients round the plant, but like mosses and liverworts, they also reproduce by spores. Ferns differ from the other pteridophytes (often referred to as the 'fern allies') in that they bear many *sporangia*, the capsules within which the spores develop, on each leaf; clubmosses, spikemosses and quillworts all have only one sporangium per leaf, and the horsetails produce special stalked hexagonal structures which each bear up to ten sporangia. Fossils of pteridophytes are known from rocks some 400 million years old.

The life cycle

The life cycle of pteridophytes has two distinct phases. In the majority of ferns a spore germinates to form an inconspicuous, green, heart-shaped, plate-like plant called a *prothallus* or *gametophyte*. Most British species of fern have a very similar prothallus stage and it takes an expert to distinguish them. A few species are distinct, e.g. that of the filmy fern *Trichomanes* is filamentous, resembling an alga. The adder's tongues, horsetails and clubmosses have minute tuber-like prothalli that live underground and therefore lack chlorophyll. The quillworts and *Selaginella* are even more specialised: their mega- and microspores germinate *within* the ruptured spore wall and form a minute prothallus bearing either archegonia or antheridia respectively. In all these cases the gametophyte produces the sex organs; *antheridia* which contain spermatozoids, and *archegonia* which each hold one egg-cell, are borne on the underside of the prothallus. The spermatozoids swim in a film of water to the egg-cells, usually to those of another prothallus. A new and quite different plant is formed from the resulting fertilisation. This *sporophyte* plant will mature to produce the conspicuous spore-bearing leaves we examine to identify the fern.

Structure of the fern plant

In most ferns the dominant organ is the leaf, the stem bearing it being an erect or creeping rhizome. Like all rhizomes it contains food reserves that enable the plant to overwinter. Erect rhizomes will eventually fall over through lack of support, but further growth is always upright; this condition is referred to as 'ascending'. In most species the actively growing area is covered with scales (or hairs) which may be diagnostic. All leaves are arranged spirally on the stem (rhizome); if the rhizome is slow

Introduction (*continued*)

growing then the bunch of leaves at the apex will form a 'shuttlecock', the characteristic habit we associate with ferns. Leaves arising from creeping, and often fast growing, rhizomes, are also spirally arranged, but appear to rise singly or in twos or threes. Leaves of ferns range from being simple (undivided) and entire (not cut in any way) as in hart's tongue to highly dissected as in bracken.

In all ferns the *sporangia* arise from the leaf-blade along or at the end of a vein. In some species the leaf bearing the sporangia is quite different in shape, often having reduced blade tissue. In the majority of ferns, the sporangia are borne in clusters called *sori*. These vary in shape from circular to linear, or may form a continuous line either at the margin or beside the midrib. The position and type of sorus are diagnostic. In many species the young sporangia are protected by a membranous cover or 'flap' called an *indusium*; as the spores ripen this indusium will shrivel or lift and allow the sporangia to dehisce.

The sporangia of the majority of ferns are stalked capsules which have a band of thick-walled cells (called the *annulus*) almost encircling the sporangium. On maturity, when the spores are ready for dispersal, these cells contract, rupturing the thinner-walled cells of the sporangium wall. The annulus then acts like a hinge, the sporangium gapes, allowing the spores to escape. The spores vary in shape, depending on the genus or species: some are bean-shaped, others may be tetrahedral (or spherical).

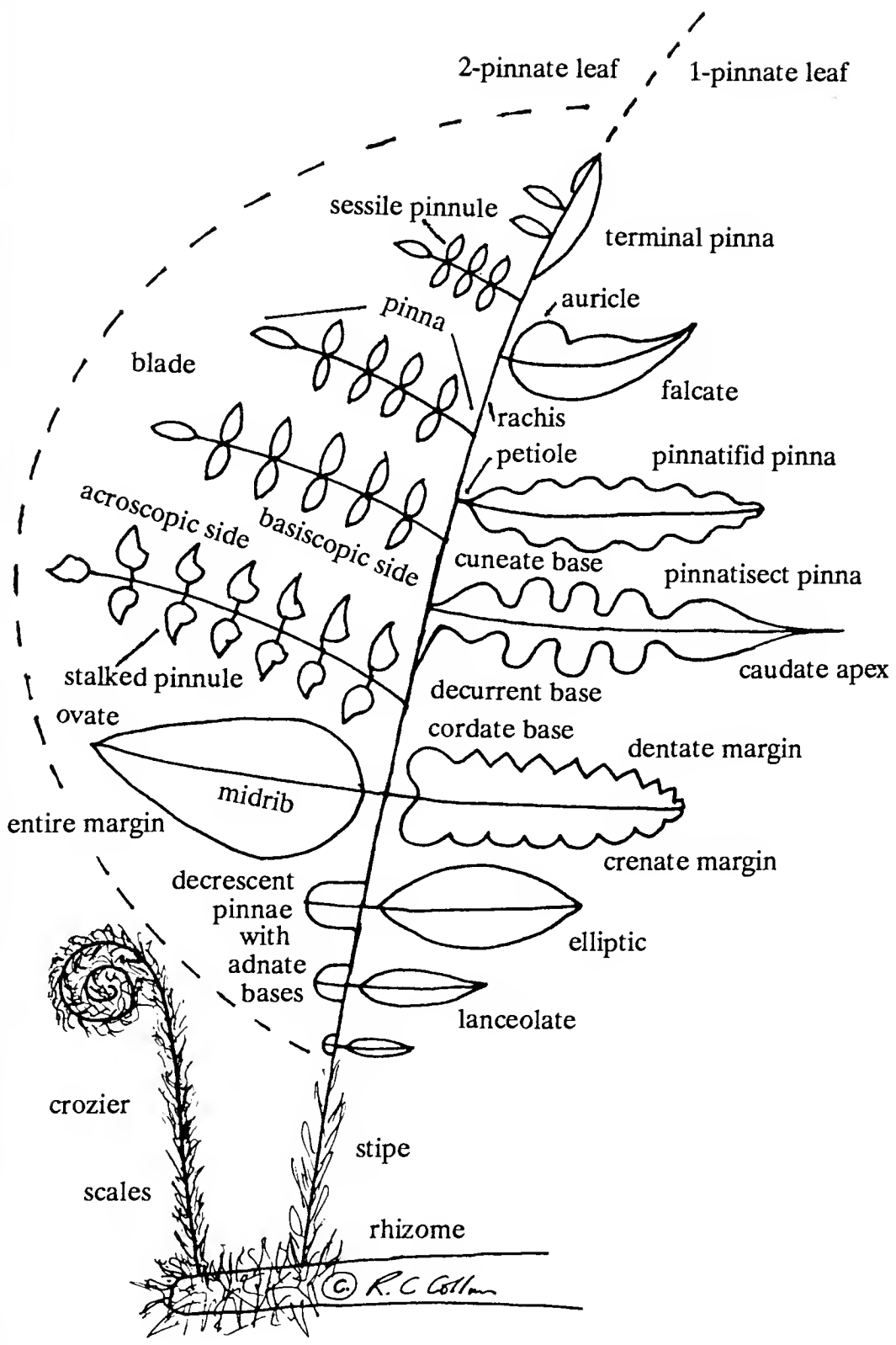
Structure of other pteridophytes

The general features of the clubmosses, quillworts and horsetails have been described under those genera. The relatively large, rush-like leaves from a corm-like stem of both aquatic and terrestrial quillworts are similar in structure. In the clubmosses and spikemosses, the stems are aerial and variously branched, like flowering plants. Horsetails also have aerial stems, but these are hollow; the pattern of epidermal cells and details of the inner structure are both diagnostic. All horsetails are rhizomatous and successful colonisers; the field horsetail has root tubers as additional storage organs. The leaves of these groups are small compared to most true ferns and often referred to as *microphylls*; they lack complex venation, and in some cases may be even without a midvein. The sporangia of the other pteridophytes differ in detailed structure from ferns and all are borne on the abaxial (upper) face of the leaf or in the leaf axil. In *Selaginella* and *Isoetes* sporangia and spores are of two kinds (as in pillwort and *Azolla*). The clubmosses (*Lycopodium*) have spores all of one kind.

Glossary

- Acuminate** Tapering very gradually to a point.
Anastomosing Uniting to form a network.
Arcuate Curved like a bow.
Attenuate Narrowly tapering.
Clathrate (Of scales) Of lattice appearance.
Concolorous Of one uniform colour.
Contiguous Margins of adjacent organs \pm touching each other.
Coriaceous Of leathery texture.
Decumbent Prostrate with tip rising upwards.
Dimorphic Two forms, e.g. sterile and fertile leaves being markedly different in size, shape, dissection etc.
Dichotomous Branching equally into two.
Dorsiventrally (Of a branch system) flattened to give an upper (dorsal) and a lower (ventral) aspect.
Fasciculate Densely clustered.
Filiform Thread-like.
Flabellate Spread like a fan.
Glabrous Without hairs or scales.
Herbaceous Of thin texture.
Imbricate Overlapping like roof-tiles.
Indusium Flap of tissue covering young sorus, often membranous.
Mucronate Abruptly ended by a short point.
Ovate 2-dimensional egg-shaped.
Ovoid 3-dimensional egg-shaped.
Paraphyses Small, branched hairs among sporangia.
Patent Held at right angles to axis.
Peduncle Stalk of a cone.
Peltate Attached centrally.
Petiolate With a stalk or petiole.
Retuse With a rounded, shallowly notched end.
Receptacle That part of the sorus from which the sporangia develop.
Reticulate Like a network.
Scabrid Rough with many minute projections.
Scarious Thin, dry, membranous tissue lacking pigment and appearing translucent.
Septate With cross-walls, i.e. composed of more than one cell.
Sorus A circumscribed group of sporangia, often with an indusium.
Spathulate Spatula-shaped.
Spinulose With spine-like teeth.
Sporangia Capsule within which spores develop.
Stolon A 'runner' from the stem that produces a new plant.
Stramineous Straw-coloured.
Subulate Almost linear, tapering from a broad base.
Terete Cylindrical.
Verrucose (Of a spore or surface) covered with small warts.

Glossary (continued)



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Further information

The British Pteridological Society is an international society for all those interested in ferns and their allies at all levels.

It publishes its own journal and books, holds field meetings, workshops and symposia, distributes spores and plants.

Details from the Membership Secretary, at the address below.

The British Pteridological Society
c/o Botany Department
The Natural History Museum
Cromwell Road
London
SW7 5BD



General key to British ferns and allied plants

- 1 Plants free-floating on surface of freshwater; branches pinnate and opposite; leaves blue-green or red, in 2 ranks, imbricate, <3 mm **Azolla filiculoides** (72)
- 1 Plants rooting in or on substrate 2
- 2 Plant with simple or branched, \pm hollow, jointed stems; leaves reduced to a vestigial whorl of teeth around nodes **Equisetum** (see p 26)
- 2 Plants not as above 3
- 3 Plants with rush-like leaves, round or triangular in cross-section 4
- 3 Leaves with a typical blade and stipe, arising from a terrestrial rootstock, or leaves very small, <10 mm, without a distinct stipe, arranged spirally or in 4 distinct ranks along an aerial stem 5
- 4 Plants producing rosettes of leaves from a short, erect, corm-like stem; sporangia embedded in the spatulate leafbase **Isoetes** (see p 18)
- 4 Leaves arising singly from a wide-creeping slender rhizome; sporangia enclosed in a hard, pill-like case attached to the rhizome **Pilularia globulifera** (28)
- 5 Plants 2.5-25 cm high; stem aerial, creeping or ascending, branching dichotomously; leaves <10 mm long, arranged spirally or in 4 ranks **Lycopodiaceae** or **Selaginellaceae** (see p 2)
- 5 Plants not as above 6
- 6 Leaves fleshy; sporangia borne on a special structure arising from the base of the leaf-blade **Ophioglossaceae** (see p 47)
- 6 Leaves membranous, herbaceous or leathery; sporangia either marginal or on the underside of leaves 7
- 7 Leaves membranous, almost translucent, arising intermittently from a wiry slender rhizome; sporangia in discrete pockets on the margins of the leaf lobes **Hymenophyllaceae** (see p 67)
- 7 Leaves thicker, arising from creeping or erect rhizomes; sporangia in variously shaped sori on back of leaves, or if marginal then not in discrete pockets 8

General key (*continued*)

- 8 Plants annual; leaves usually < 10 cm, 2- to 3-pinnate, green throughout, texture very soft; sporangia scattered along length of or at tip of segment vein (Channel Isles only)
Anogramma leptophylla (26)
- 8 Plants perennial, often wintergreen; leaves entire to 4-pinnate, if < 10 cm then not 2- to 3- pinnate and green throughout with very soft texture; sporangia arranged in distinct median or marginal sori 9
- 9 Sori marginal, with linear indusium or covered by a thin, membranous (not just inrolled) leaf margin 10
- 9 Sori variously disposed on the back of the leaf 12
- 10 Leaves 1- to 3-pinnate, ultimate segments wedge- or fan-shaped; stipe and rachis shiny, black
Adiantum capillus-veneris (27)
- 10 Leaves 1-pinnate or more divided, ultimate segments narrowly triangular or linear; stipe and rachis green or red-brown 11
- 11 Leaves 0.5 to several metres tall, 2- to 3-pinnate-pinnatifid, arising singly from an underground rhizome
Pteridium aquilinum (35a, b)
- 11 Leaves <0.6 m tall, 1-pinnate, arising in clusters from an erect or short-creeping surface rhizome **Pteris** (A2, A3)
- 12 Leaves pinnatisect; sterile leaves with free veins 13
- 12 Leaves simple, pinnate or more compound (if sterile leaves pinnatisect then veins anastomosing) 14
- 13 Leaves in clusters, strongly dimorphic; sori linear, parallel to midrib, indusiate; rhizome erect **Blechnum spicant** (71)
- 13 Leaves arising singly, not dimorphic; sori round to oval, without indusia; rhizome creeping **Polypodium** (see p 74)
- 14 Leaves strongly dimorphic, i.e. sterile and fertile leaves differing markedly in general appearance 15
- 14 Leaves not strongly dimorphic, i.e. sterile and fertile leaves similar or not very different in general appearance 18
- 15 Leaves arising singly from creeping rhizome; veins anastomosing **Onoclea sensibilis** (A5)
- 15 Leaves in clumps or 'shuttlecocks' from erect rhizome; veins free 16

General key (*continued*)

- 16 Leaves 2-pinnate; sporangia borne on special tassel-like pinnae
usually devoid of lamina tissue **Osmunda regalis** (24)
- 16 Leaves pinnate-pinnatisect or 3- to 4-pinnate; sporangia
protected by inrolled lamina 17
- 17 Leaves pinnate-pinnatisect **Matteuccia struthiopteris** (A6)
- 17 Leaves 3- to 4-pinnate **Cryptogramma crispera** (25)
- 18 Sorus linear or oblong; indusium a flap-like membrane attached
by its long side 19
- 18 Sorus \pm round; indusium present or lacking, but not as above 20
- 19 Leaves 2-3-pinnate, tissue soft, not wintergreen; scales not
clathrate; most sori J-shaped **Athyrium filix-femina** (49)
- 19 Leaves simple to 2-pinnate, tissue tough, usually wintergreen;
scales clathrate; sori always linear or oblong
Asplenium (see p 92)
- 20 Leaf-blade triangular, as wide as long; rhizome slender,
long-creeping 21
- 20 Leaf-blade elliptic, lanceolate or ovate (if triangular then
rhizome erect); rhizome various 22
- 21 Leaves without glands, pinnules pinnatisect, segments
c. 1mm wide; sorus indusiate **Cystopteris montana** (55)
- 21 Leaves with or without glands, pinnules pinnatifid, segments
c. 2.5 mm wide; sorus exindusiate **Gymnocarpium** (51, 52)
- 22 Leaves glandular, smelling of lemon
Oreopteris limbosperma (38)
- 22 Leaves not glandular, not smelling of lemon 23
- 23 Indusia kidney-shaped 24
- 23 Indusia variously shaped or lacking 25
- 24 Leaf lanceolate, scant scales at base of stipe, minute hairs on
rachis and pinna midribs (x 10), margin of fertile segments
obviously inrolled **Thelypteris palustris** (36)
- 24 Leaf lanceolate to triangular, base of stipe moderately to very
densely scaly, minute hairs never present (x 10), margin of
fertile segments not inrolled **Dryopteris** (see p 148)
- 25 Indusium round, peltate, persistent 26
- 25 Indusium variously shaped or lacking, never round
and peltate 27

General key (*continued*)

- 26 Leaf segments decreasing towards apex of leaf; veins free
Polystichum (see p 74)
- 26 Terminal pinna as large as the lateral ones; veins anastomosing
Cyrtomium falcatum (A4)
- 27 Leaf-blade ovate-triangular, finely pubescent, flexed back at
45° or more **Phegopteris connectilis** (37)
- 27 Leaf-blade linear-lanceolate, glabrous, ± erect 28
- 28 Rhizome erect, leaves tufted or in a 'shuttlecock'; mountain
plants on rock or in screes 29
- 28 Rhizome creeping; leaves arising singly or in small clusters 30
- 29 Leaves 18-60 cm long; indusium lacking
Athyrium distentifolium (50a, b)
- 29 Leaves 3-15 cm long; indusium fringed with long hairs
Woodsia (56, 57)
- 30 Rhizome long-creeping; leaves pinnate-pinnatisect; marsh
plants **Thelypteris palustris** (36)
- 30 Rhizome short-creeping, ascending; leaves 2-pinnate; plants of
rocks, walls, wooded ravines **Cystopteris** (53, 54)

Systematic arrangement of British ferns and allied plants

LYCOPODIACEAE

Lycopodium
Lycopodiella
Huperzia
Diphasiastrum

SELAGINELLACEAE

Selaginella

ISOETACEAE

Isoetes

EQUISETACEAE

Equisetum

OPHIOGLOSSACEAE

Botrychium
Ophioglossum

OSMUNDACEAE

Osmunda

ADIANTACEAE

Cryptogramma
Anogramma
Adiantum

PTERIDACEAE

* Pteris

MARSILEACEAE

Pilularia

HYMENOPHYLLACEAE

Hymenophyllum
Trichomanes

POLYPODIACEAE

Polypodium

DENNSTAEDTIACEAE

Pteridium

THELYPTERIDACEAE

Thelypteris
Phegopteris
Oreopteris

ASPLENIACEAE

Asplenium

WOODSIACEAE

* Matteuccia
* Onoclea
Athyrium
Gymnocarpium
Cystopteris
Woodsia

DRYOPTERIDACEAE

Polystichum
* Cyrtomium
Dryopteris

BLECHNACEAE

Blechnum

AZOLLACEAE

Azolla

* Alien genus

1-7 The Clubmosses

Lycopodiaceae and Selaginellaceae

Introduction

The clubmosses proper (Lycopodiaceae) are a large and widespread group, many terrestrial on mountains throughout the world, others epiphytic in tropical areas. It is an ancient group that formed large tree-like plants in prehistoric times. Lesser clubmosses, or, as they are more widely known, spikemosses, (Selaginellaceae) are equally ancient but are now mostly tropical with over 600 herbaceous species in a single genus.

Characteristics of Lycopodiaceae

Mainly herbs with stems dichotomously branched, often thick and leathery (coriaceous), simple leaves, either all similar and spirally arranged, or, in one genus (*Diphasiastrum*), in four ranks; spores all of one size, borne in single sporangia attached to the base of fertile leaves, *sporophylls*, similar to or different in shape and size to sterile leaves, and arranged in 'cones' or in zones on the stem, sporangia opening by a transverse slit. Four genera are represented in the British Isles.

Characteristics of Selaginellaceae

In many ways similar to the above, but leaves more delicate; (herbaceous); one group (subgenus *Stachygynandrum*), the larger by far and given full generic rank by some, has two kinds of leaf, dorsiventrally arranged as two median ranks flanked by a lateral rank of larger leaves on either side; the other (subgenus *Selaginella*) has uniform leaves and looks like a smaller version of Lycopodiaceae; spores are of two kinds in separate sporangia on *sporophylls* as in Lycopodiaceae and arranged in loose or compact 'cones'; sporangia opening by transverse slits. Only one native species is found in the British Isles, with an African species, *S. kraussiana* (A1, see p. 187), as an established alien in more clement areas of our islands.

Field key to species

- | | | |
|---|---|---|
| 1 | Leaves all similar, radially arranged in more than 4 ranks | 2 |
| 1 | Leaves \pm to obviously dimorphic, arranged in 4 ranks | 6 |
| 2 | Sporophylls in distinct cones at apex of stem | 3 |
| 2 | Sporophylls in zones along stem, not in distinct apical cones | 4 |

- 3 Cones sessile, leaves sharply pointed

Lycopodium annotinum (1)
- 3 Cones pedunculate often on branched stems, leaves drawn into
a fine white or red-brown hair-like point

Lycopodium clavatum (2)
- 4 Erect stems branching dichotomously, some leaves with bulbils

Huperzia selago (4)
- 4 Erect stems branching unequally, bulbils never present 5
- 5 Leaves on creeping stems curved upwards, without teeth

Lycopodiella inundata (3)
- 5 Leaves not curved upwards, with spinose teeth

Selaginella selaginoides (7)
- 6 Largest leaves \pm at right angles to stem, membranous

Selaginella kraussiana (A1)
- 6 Largest leaves \pm parallel to stem, coriaceous 7
- 7 Ventral leaves trowel-shaped, petiolate; lateral leaves tapered
to stem; cones sessile

Diphasiastrum alpinum (5)
- 7 Ventral leaves acutely subulate, sessile; lateral leaves
abruptly narrowed to meet stem; cones pedunculate

Diphasiastrum complanatum morph decipiens (6)

Hybrids

Hybridisation is common between species (and subspecies) of *Diphasiastrum* in northern Europe, the offspring showing some fertility. Because of this, there is some debate as to the status and rank of some intermediate taxa which have been called species, subspecies or hybrids by various authors. The yellow cypress clubmoss (6) is probably derived from *D. alpinum* crossing with *D. complanatum*, and has been referred to at all ranks under the name *issleri*. We now believe that to be a different plant not so far found in Britain. Our British plant is also found on mainland Europe, but pending further investigation we have used here the epithet *decipiens*, a varietal name given to the Gloucestershire plant by Syme. Backcrossing of *decipiens* with *D. alpinum* may occur in Britain (e.g. in the Malvern Hills).

Huperzia selago with abortive spores has been found in Europe suggesting this taxon may be a complex of closely related 'species'. Both they, and their hybrids, may be present in Britain.

1 Interrupted Clubmoss

Lycopodium annotinum L.



LEAVES arranged radially, those on main stem 3-5 mm long, lanceolate, adpressed, sparse, those on branches 5-7 mm, crowded, \pm spreading, \pm coarse, entire, sharply pointed; those produced at the end of the season shorter, thus demarcating successive periods of growth and giving the 'interruptions' that give the plant its name.

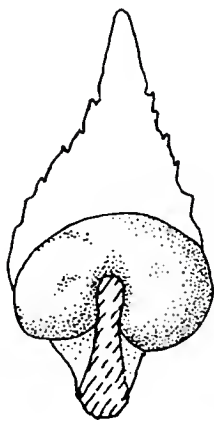
SPOROPHYLLS in solitary apical cones at the ends of erect or ascending leafy branches, without any form of peduncle.



HABIT: A sprawling plant with creeping primary stems, often up to 1 m long, with wide-spaced, fasciculate, ascending to erect branches of unequal length; wintergreen.



CONES 2-3 cm long, at the ends of branches, greenish soon becoming yellow to red-brown.



SPOROPHYLLS 1.5-2 mm, broadly ovate, margins scarious, toothed, apex drawn to a fine acute point.

HABITAT: In dwarf-shrub communities (heather, bilberry) particularly associated with ancient pine forest; a plant of well-drained sites; in mountains rarely below 450 m (1500 ft).

DISTRIBUTION: Mainly Grampian Mts and NW Scotland with one station in Cumbria. Absent from Ireland.


CONSERVATION STATUS: Vulnerable to upland afforestation and possibly atmospheric pollution.

COMPARE WITH:

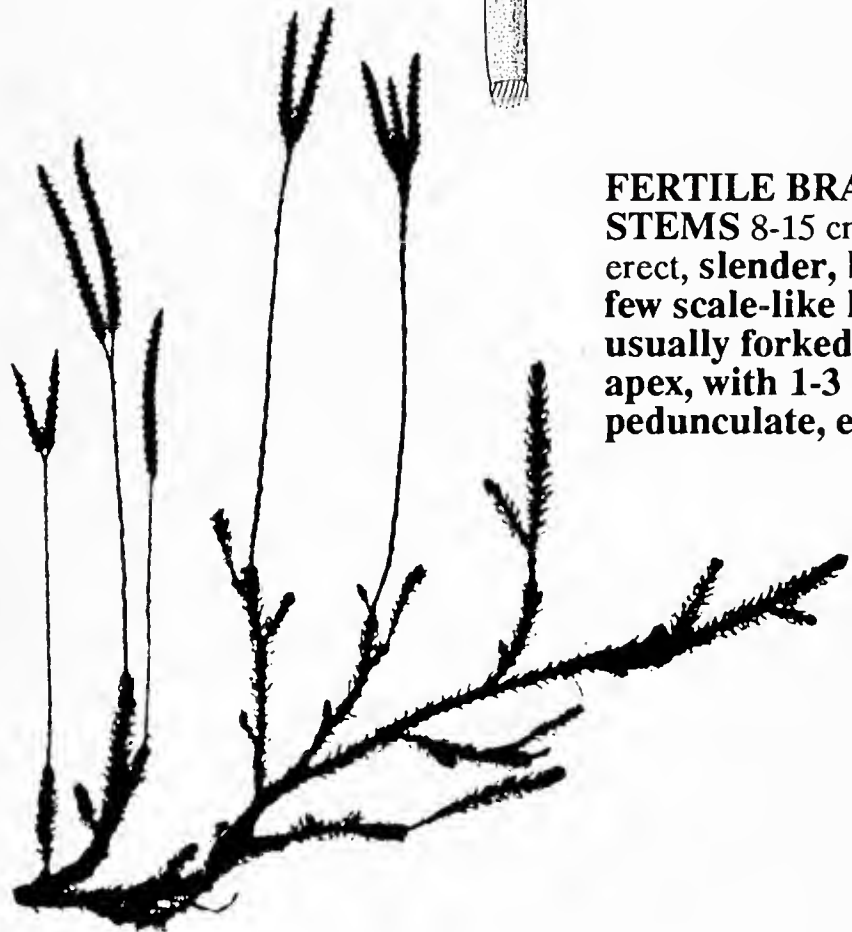
- (2) ***Lycopodium clavatum*** in which the branches are softer to the touch because of the flexible hair-points;
- (3) ***Lycopodiella inundata*** which has more slender, only shortly creeping stems and is a plant of wet lowland bogs;
- (4) ***Huperzia selago*** can only be confused when both species are very young plants; *Huperzia* lacks the sharp leaf point.

2 Stag's Horn Clubmoss

Lycopodium clavatum L.

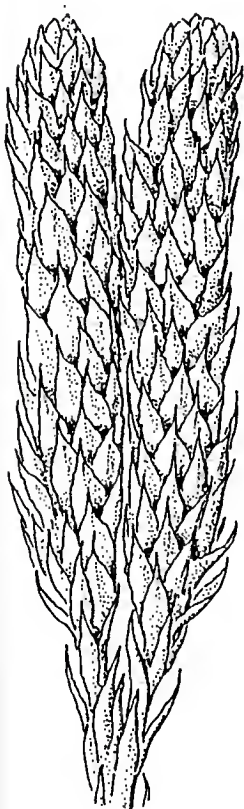


LEAVES 5-7 x 1-1.5 mm, radially arranged, linear-lanceolate, pale yellow-green, coarse, **overlapping, adpressed to stem, margin \pm entire; leaf-tips drawn into a red-brown or white hair, often falling off as the leaf ages.**

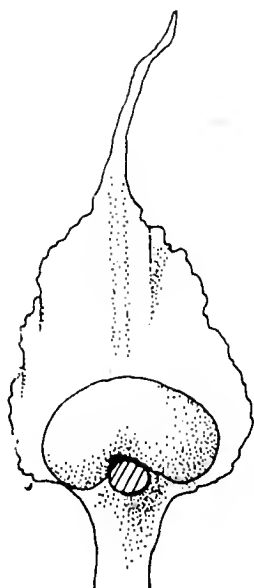


FERTILE BRANCH
STEMS 8-15 cm tall, erect, slender, bearing few scale-like leaves, usually forked at the apex, with 1-3 distinct, pedunculate, erect cones.

HABIT: Wide-creeping with a branched main stem lying close to the ground and rooting at intervals, with unequal branches; wintergreen.



CONES 1-3 in terminal cluster, 1.5-3 cm long, upright.



SPOROPHYLLS
1.5-3 mm long, ovate-triangular, pale cream, apex drawn out; margins scarious, irregularly toothed.

HABITAT: In rough mountain grassland, especially where there is a trace of base salts; also lowland on sandy heaths, on old mine tips, and on conifer plantation rides; to 800 m (2400 ft) alt.

DISTRIBUTION: Mostly in W and N Britain, but scattered on heathy sites in the south; mainly in the NE in Ireland.

CONSERVATION STATUS: Vulnerable to pasture improvement and afforestation; lost from over 170 sites in Britain alone since 1950.

COMPARE WITH:

- (1) ***Lycopodium annotinum***, noting position of fertile stems, cones and growth habit;
- (3) ***Lycopodiella inundata***, noting as above, and wet acid bog habitat.

3

Marsh Clubmoss

Lycopodiella inundata (L.) J. Holub



STERILE LEAVES 4-6 mm long, narrowly triangular to lanceolate, somewhat fleshy and awl-shaped, with a soft acute apex, **bright green with a glistening appearance**, \pm patent and in several ranks on upright stems, those on creeping stems \pm adpressed, tips curving away from substrate, often appearing in two ranks.

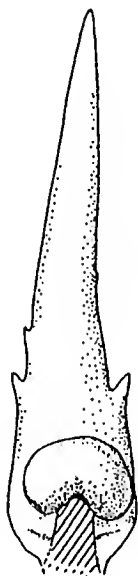
SPOROPHYLLS similar to sterile leaves, forming a solitary, terminal ill-defined cone.



HABIT: Primary stems short-creeping, slender (<2 mm), occasionally branched, rooting throughout its length, often decaying during the winter of its second season thereby breaking the plant up into small units.



CONES 1-2.5 cm long,
sessile, green initially, but
becoming olive to deep yellow.



SPOROPHYLLS up to 8 mm
long, spatulate with a few
teeth at the base,
tapered tip, spreading away
from stem.

HABITAT: In wet boggy acid and nutrient-poor sites but preferring better-drained *Sphagnum* hummocks or small peat cliffs, wheel ruts etc., especially in areas of low, open vegetation or bare peat.

DISTRIBUTION: Mainly in S and E Britain and lowland sites in Scotland N of the Forth; in Ireland, mainly in the W with records from Armagh, Offaly and Wicklow.

CONSERVATION STATUS: Vulnerable to drainage and afforestation; lost from over 100 sites since 1950. **Protected in Northern Ireland** under the *Wildlife (NI) Order, 1985*.

COMPARE WITH:

(2) ***Lycopodium clavatum*** which has hair-points on its leaves and is a plant of drier and more base-rich habitats;

(7) ***Selaginella selaginoides*** which is similar in habit, but has thinner leaves, and if fertile is obvious with its two kinds of spores. It also prefers much more base-rich flushes.

4

Fir Clubmoss

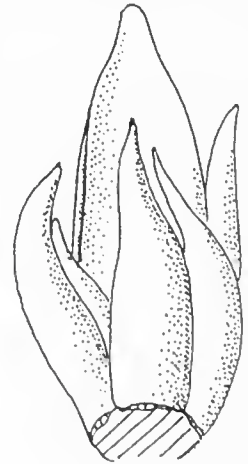
Huperzia selago (L.) Bernh. ex Schrank & C.F.P. Mart



LEAVES 2-8 mm long, lanceolate, \pm spreading, in a tight spiral around the stem, mid- to often yellow-green, apex acute, margin finely denticulate, coriaceous, rigid, leaves on young plants less coarse.



STERILE LEAVES frequently produce 'bubils' near the base, often seen as a 'crown' around the top of the stem.



STEMS 5-20 cm tall, or even larger, 1-3 mm thick.

HABIT: Plant with several forked \pm equal branches, rooted at a single basal point, stems generally erect, but tending to lean (because of exposure to wind, or lack of root support) whereupon the stems will curve to become erect; wintergreen.



SPOROPHYLLS similar to sterile leaves, not forming cones but in zones along the stem, one band produced each year, followed at the end of the season by a flush of sterile leaves.



HABITAT: In mountain-top grassland, dwarf-heath, and on rocky ledges, but spreading into lowland areas where damp frost hollows give required low temperatures.

DISTRIBUTION: Mainly a northern-montane species, in Scotland and the W of northern England, Wales and Ireland; found scattered in more lowland situations where air temperature inversions are frequent, and then mainly in the SW and with a single site in E Sussex.

CONSERVATION STATUS: Vulnerable to drainage and afforestation.

COMPARE WITH:

(1) ***Lycopodium annotinum*** in its youngest stages before its wide-creeping form is established, and older vegetative plants can look similar; it has more acutely pointed leaves and never bears bulbils.

5 Alpine Clubmoss

Diphasiastrum alpinum (L.) J. Holub



CONES 1-2 cm long, grouped at ends of leafy branches, with a short, almost non-existent peduncle bearing a few leaves intermediate in shape and texture between those of the cone and the leafy stem.



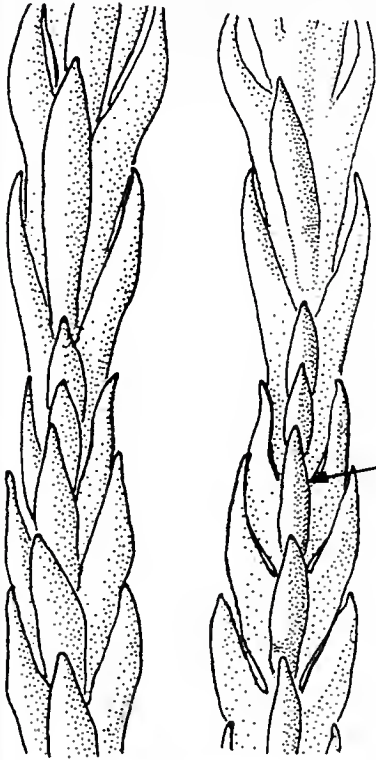
MAIN BRANCHES flattened, dichotomously forked and fan-like, the whole glaucous and resembling a cypress tree.

SECONDARY BRANCHES close together, often overlapping and compact.

LEAVES 2-3(-4) mm long, all \pm similar when young, lanceolate, becoming differentiated into opposite dissimilar pairs, forming 4 ranks.



HABIT: A low-growing, wide-creeping plant with its **main stem underground** (or deep in moss or litter), with few scale-like leaves, rooting along its length; wintergreen.

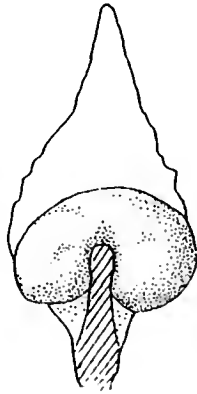


LATERAL LEAVES

acutely keeled, apex reflexed, the lower half fused to the stem, **the lower part of the keel tapering into the stem.**

MEDIAN LEAVES

narrower than lateral ones, lanceolate and not keeled, **those on the lower (ventral) side** (best seen on branches of the previous year's growth) **trowel-shaped, with an angled petiole holding it away from, but parallel to, the stem** (the blade often appearing skewed in dried specimens).



SPOROPHYLLS scale-like, broadly ovate, drawn into a long blunt apical tip, greenish becoming yellow-brown on maturity.

HABITAT: Mountain grassland and dwarf-shrub heath usually where competition from other plants is low; rarely below 600 m (2000 ft).

DISTRIBUTION: In the higher hills of Wales, N England and Scotland with outliers in S Pennines (Derbyshire), Malverns (Worcestershire); in Ireland on higher hills of the N, West Mayo, West Galway, Offaly and Wicklow.

CONSERVATION STATUS: Vulnerable to upland grassland improvement and afforestation.

COMPARE WITH:

(6) **D. complanatum** morphotype **decipiens** is distinguished by its more yellow-green foliage, more open branching and shape of the leaves, especially the ventral leaves.

6 Yellow Cypress Clubmoss

Diphasiastrum complanatum (L.) J. Holub
morphotype *decipiens* (sensu Syme)

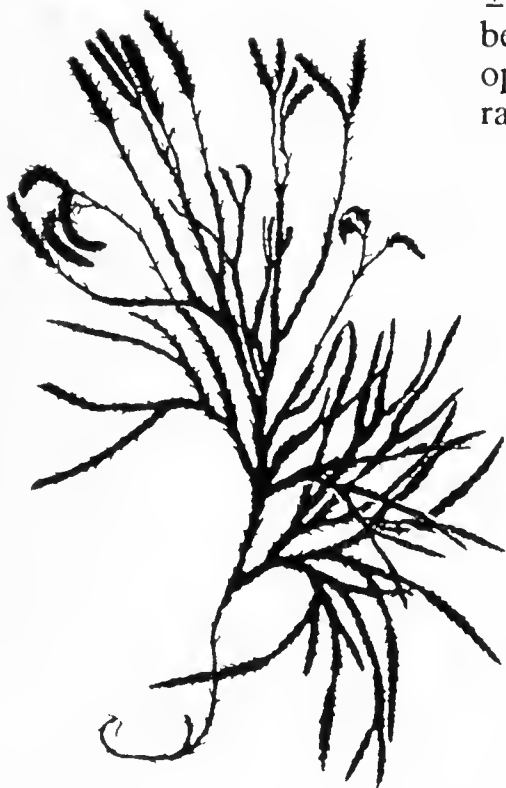


CONES 1.5-2.5 cm long, borne on an erect, elongated peduncle bearing few ovate-elliptic, scale-like leaves.

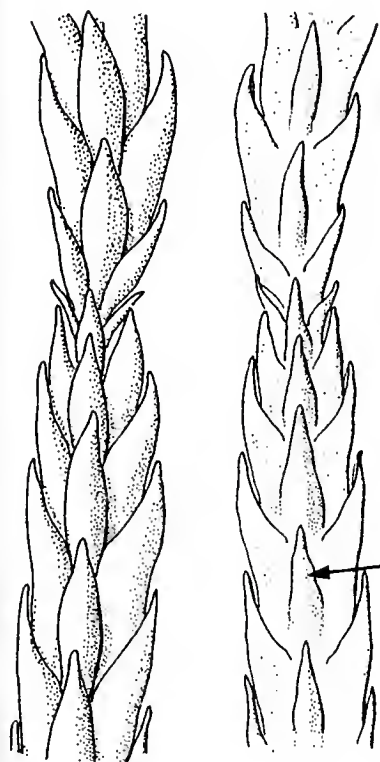
MAIN BRANCHES very similar to (5) *D. alpinum*, the whole plant being a distinct yellow-green colour.

SECONDARY BRANCHES flabellate, usually longer and more open than (5) *D. alpinum*.

LEAVES 2-5 mm long, all \pm similar when young, lanceolate, becoming differentiated into opposite dissimilar pairs, forming 4 ranks.



HABIT: A wide-creeping plant with its **main stem above ground** (or rarely in moss or litter), with few scale-like leaves, rooting along its length; wintergreen.

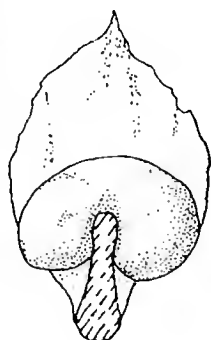


LATERAL LEAVES

acutely keeled, apex reflexed, the lower half fused to the stem, **the middle part of the keels of opposite pairs parallel, curving abruptly at the base into the stem.**

MEDIAN LEAVES

narrower than lateral ones, lanceolate and not keeled, **those underneath (ventral leaves)** (best seen on branches of the previous year's growth) **narrowly triangular, sessile, with a more acute apex.**



SPOROPHYLLS ovate-orbicular, with a shorter more apiculate apex than in (5) *D. alpinum*.

HABITAT: In undisturbed dwarf-shrub (heather-bilberry) heath; reaches lower altitudes than *D. alpinum* (> 270 m, 800 ft).

DISTRIBUTION: Often associated with areas of Caledonian pine forest in Scotland; not so far confirmed for Wales, possibly a hybrid population in Worcestershire; not recorded from Ireland.

CONSERVATION STATUS: Vulnerable to moor-burning and conversion of lowland heaths.

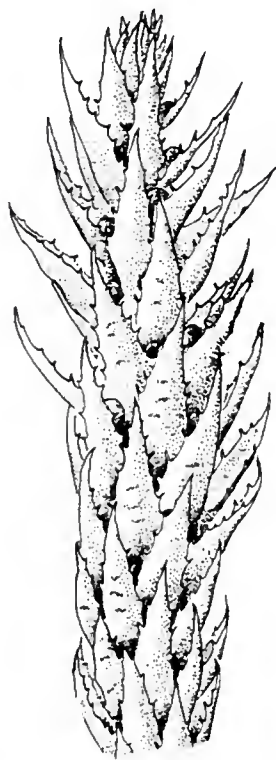
COMPARE WITH:

(5) ***Diphasiastrum alpinum***, which has different sterile leaves, sessile cones and is of a general glaucous colour.

***Diphasiastrum complanatum* subsp. *complanatum*:** this subspecies has so far not been found in the British Isles but could be found in similar sites at low altitude. It has very small appressed, triangular, acutely pointed ventral leaves with cones on tall, erect peduncles very similar to those of *Lycopodium clavatum*.

7 Lesser Clubmoss

Selaginella selaginoides (L.) Beauv. ex Schrank
& C.F.P. Mart.



MAIN STEMS prostrate, occasionally branched, terminating in a cone on an erect shoot, 2-10 cm tall and bearing dormant vegetative shoots at its base.

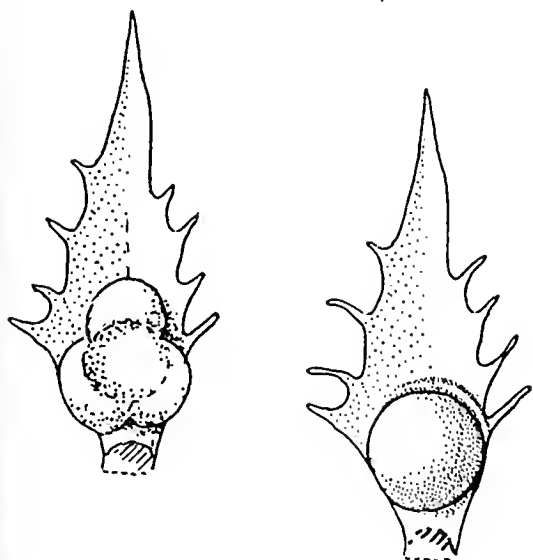
CONES ill-defined, 2-3 cm long, increasing in length as sporangia mature and dehisce.



STERILE LEAVES spirally arranged, 2-3 mm long and crowded on the dormant shoots, up to 5 mm and well-spaced on fertile stems, lanceolate, **with few spinose teeth on margin**, apex acute, texture thin.



HABIT: A low, prostrate, moss-like plant with erect, unbranched, cone-bearing stems that have several dormant branches at their base which are wintergreen and will develop into fertile branches the following year.



SPOROPHYLLS similar to sterile leaves, but wider; forming loose terminal cones.

SPORANGIA and SPORES of two kinds on separate sporophylls; those containing megaspores at the base of the cone, 3-4-lobed, opening into the same number of valves; those containing microspores in the upper part of the cone, globose, with two valves.

MEGASPORES salt-grain sized (c. 600 μm) (x 50), verrucose, ash-grey.

MICROSPORES 30-38 μm (x 400), deep orange.

HABITAT: In damp flushes and seepage areas which contain a significant amount of base-rich salts; associated with snow patches in mountains; in sand-dune slacks at sea-level.

DISTRIBUTION: A northern-montane species; in Britain not south of Merioneth; in Ireland not south of Clare-Carlow except for one site near Wexford town.

CONSERVATION STATUS: Vulnerable to drainage and change of land-use; lost from over 70 sites in Britain and from 35 in Ireland since 1950.

COMPARE WITH:

(3) *Lycopodiella inundata* (small plants) has thicker, \pm curved leaves without teeth; Similar also to some sterile mosses (*Atrichum*, *Mnium* spp.) but these are more delicate and have no basal branches.

8-10 The Quillworts

Isoetaceae: *Isoetes*

Introduction

Quillworts are an ancient and very distinct group of plants related to clubmosses rather than true ferns. Two species are normally submerged aquatics, and probably very common in the lakes where recorded although usually they are difficult to see without diving. The third is a terrestrial mediterranean plant reaching only the SW of Britain.

Characteristics of Isoetes

Stem short and corm-like, bi- or tri-lobed in cross section; roots basal, dichotomously branched; leaves in a rosette from sunken stem apex, tapering from a broad, sheathing base; sporangia solitary, spherical or ovoid, 5-8 mm wide, embedded in inner face of leaf bases and partially covered by membranous tissue, containing either large spores (*megaspores*) which can easily be seen by the naked eye and are diagnostic in their sculpturing, or smaller *microspores* which are closer in size to fern spores (both are found on the same plant, but not on the same leaf).

Spore dispersal of a submerged aquatic can be helped by water currents, but plants growing deep in the closed system of a lake cannot spread easily to another lake. In storm conditions those not too deeply immersed may be dislodged or otherwise break up, and fertile leaves washed up on shore with spores being dispersed by birds or wind. The land quillwort may have its decaying sporangia broken up by soil invertebrates and the spores may get washed through the soil or brought to the surface and dispersed by wind and animals' feet.

Field key to species

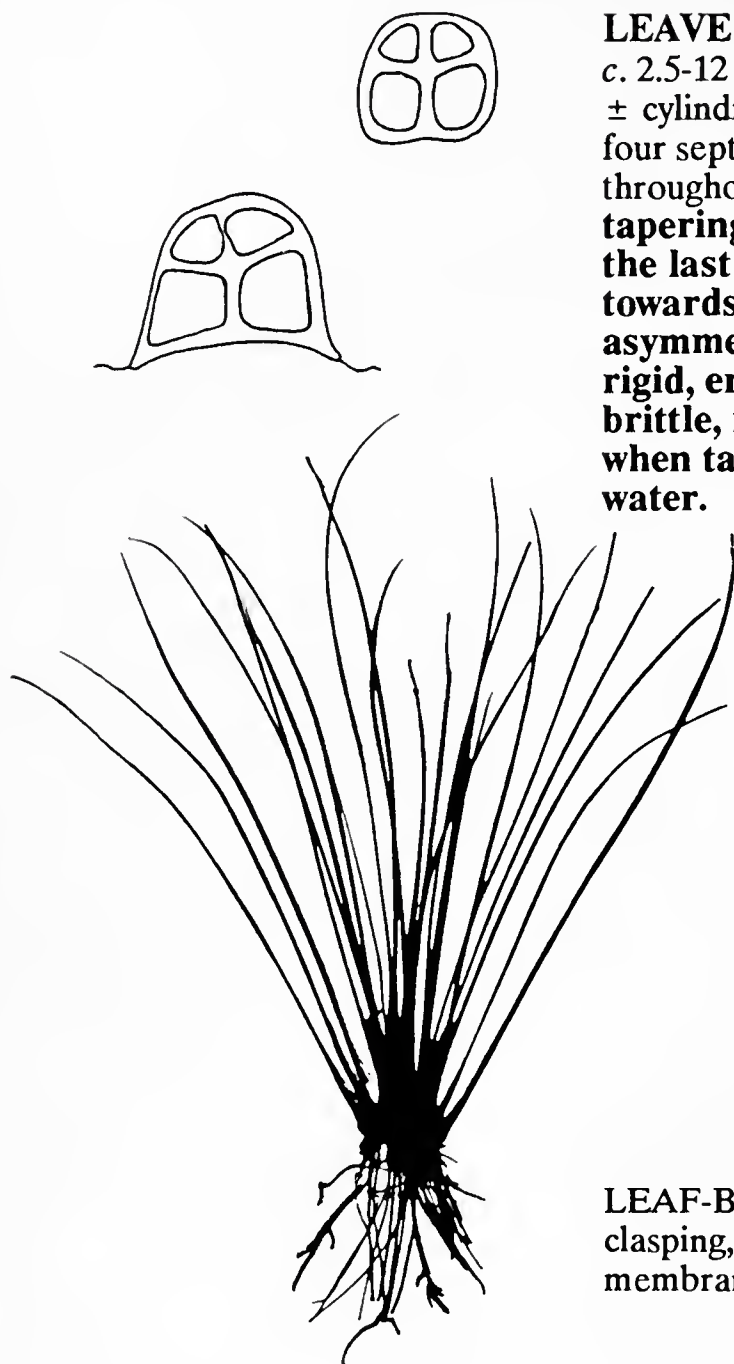
- 1 Plant terrestrial, leaves dying down in April/May **histris** (10)
- 1 Plant normally submerged, leaves present throughout the year
2
- 2 Leaves tapered from the base, flaccid, clinging together when removed from the water; megaspores spinulose
echinospora (9)
- 2 Leaves not tapered from base, stiff, remaining rigid when removed from water; megaspores with blunt anastomosing ridges
lacustris (8)

Hybrids

I. echinospora and *I. lacustris* are rarely found growing in the same lake. When they do grow together, as for example they do at Cogra Moss, Cumbria, they may hybridise (= *I. x hickeyi* Taylor & Luebke). The offspring appear intermediate in morphology, and each megasporangium contains several much smaller, often flatter, abortive megaspores. There is evidence from cytology and isoenzyme studies that hybrids of the same parentage have doubled their chromosomes and formed fertile plants in lakes in the French Pyrenees. These were described by nineteenth century botanists as *Isoetes brochonii* Motelay. Some plants with large megaspores and blunt tubercles on their upper faces from Scottish and Welsh lakes may prove to be this species and need further investigation.

8 Common Quillwort

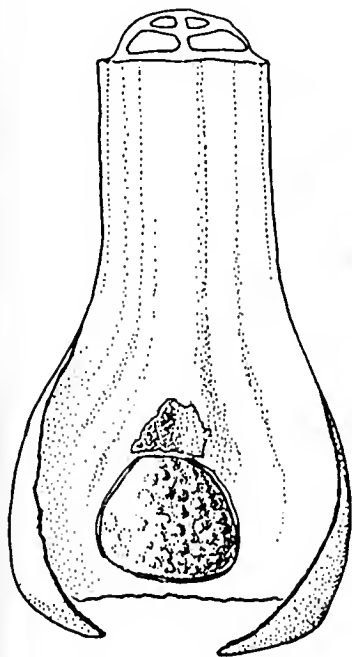
Isoetes lacustris L.



LEAVES 10-45 cm long, c. 2.5-12 mm wide, \pm cylindrical, containing four septate air canals throughout their length, **tapering only slightly in the last few centimetres towards a rather blunt asymmetrical point**, rigid, erect, somewhat brittle, remaining stiff when taken out of the water.

LEAF-BASE broad, clasping, with a wide membranous margin.

HABIT: A submerged, evergreen, aquatic plant with a rosette of leaves arising from a corm-like, 2-lobed stem embedded in the lake bottom substrate; roots brownish, dichotomously branched. Often recorded only as storm-washed material on lake shore, but usually present in some quantity, forming a dense turf on deeper lake bottoms.



SPORANGIUM at base of fertile leaf, containing either mega- or microspores.



MEGASPORES
500-570 μm diam.,
greyish-white when dry,
the mature spore wall
showing anastomosing
ridges (x 20) that
resemble brain-coral.

NB: When considerable variation in spore size is seen within a sporangium, spores may be abortive and the plant a hybrid.

HABITAT: In upland tarns and lakes, optimally at around 2 m depth, although occasionally to 6 m in very clear water, in varying substrates from coarse silt to fine mud, in waters of low nutrient content. Although it can tolerate more nutrients than *I. echinospora*, competition both from other vascular plants and algae may be a limiting factor in its distribution.

DISTRIBUTION: Throughout N to SW Scotland and the S Uplands, the English Lake District, N and W Wales, generally associated with acid rocks; in Ireland, mainly in the N and W.

CONSERVATION STATUS: Vulnerable to nutrient enrichment from upland moorland 'improvement'

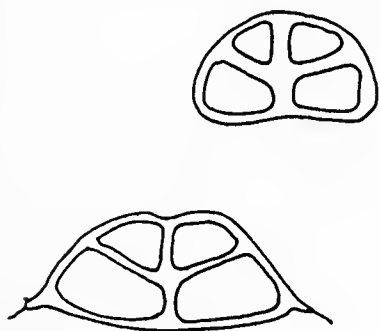
COMPARE WITH:

(10) *I. echinospora* which has leaves that taper from the base and spiny megaspores.

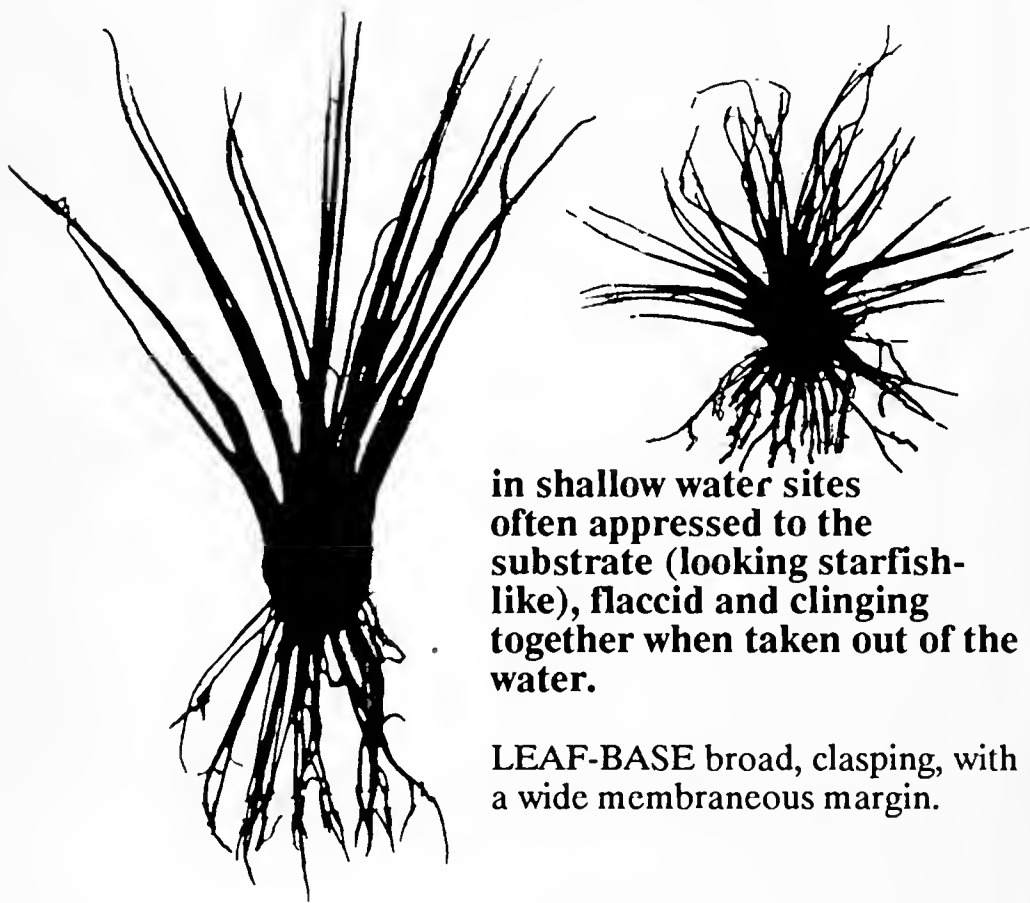
Superficially similar to *Littorella uniflora*, which has stolons, white roots and a spongy tissue throughout its leaf (not the four channels as above).

9 Spring Quillwort

Isoetes echinospora Durieu



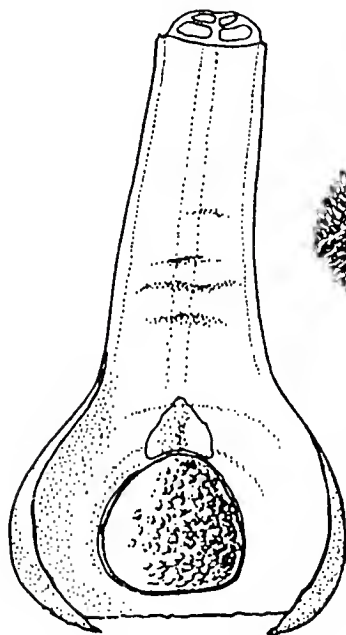
LEAVES 3-25 cm long,
c. 1.5-3 mm wide near the base,
± cylindrical or with a slightly
flattened upper (adaxial) face,
containing 4 septate air canals,
tapering almost immediately
from the base to a slender,
acute point, initially erect, but
soon bending away from the
centre of the rosette,



in shallow water sites
often appressed to the
substrate (looking starfish-
like), flaccid and clinging
together when taken out of the
water.

LEAF-BASE broad, clasping, with
a wide membranous margin.

HABIT: A submerged aquatic evergreen plant with a rosette of leaves arising from a corm-like, 2-lobed stem, embedded in the lake bottom substrate; roots brownish, dichotomously branched. Often recorded only as storm-washed material on lake shore where occasional plants will re-establish themselves and continue growing, but usually present in some quantity, though rarely forming continuous swards in deeper water as *I. lacustris* can.



SPORANGIUM at base of fertile leaves, containing either mega- or microspores.

MEGASPORES

420-450 μm diam., chalky-white, densely spiny on all faces (x 20, only seen when dry and mature - late summer and autumn).

NB: When considerable spore size variation is seen within a sporangium, spores may be abortive and the plant a hybrid.

HABITAT: In upland lakes, optimally at around 2 m depth, not recorded as deep as *I. lacustris*; in varying substrates from sand and coarse silt to fine mud, usually in acid waters of very low nutrient content although tolerating relatively high sodium and magnesium levels; rarely found in the same lakes as *I. lacustris*.

DISTRIBUTION: Scattered throughout the range of *I. lacustris* but frequently at lower altitudes and in maritime situations; its rareness in the Cumbrian lakes is difficult to explain; in Ireland, confined to the western seaboard.

CONSERVATION STATUS: Possibly increasing due to acidification of lakes, yet vulnerable to nutrient enrichment from farmland or moorland 'improvement'; losses are difficult to estimate.

COMPARE WITH:

(9) *I. lacustris*, megaspore diameter and sculpturing (only seen when mature in late summer/ autumn at x 20) is the only sure way of determining the majority of specimens, although the star-like habit and tapered leaf is a good indicator of *I. echinospora*.

Superficially similar to the flowering plants *Littorella uniflora*, and particularly *Subularia aquatica*, both of which have white roots and thin stolons.

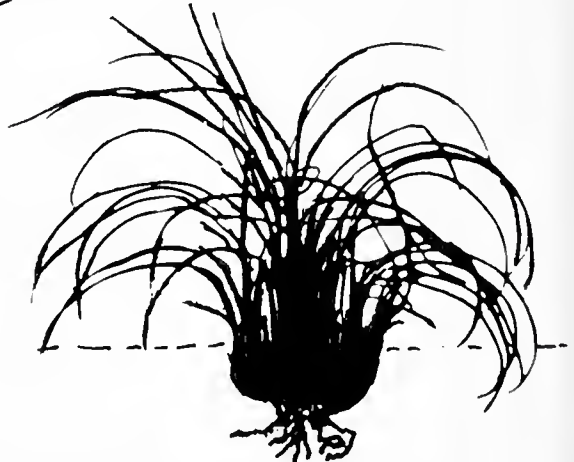
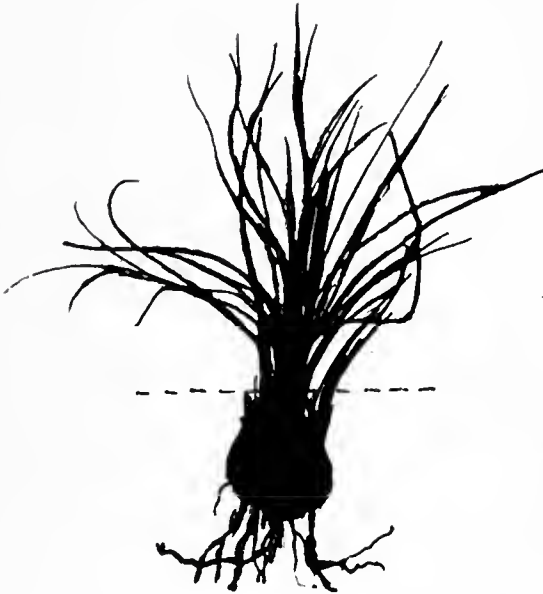
10 Land Quillwort

Isoetes histrix Bory

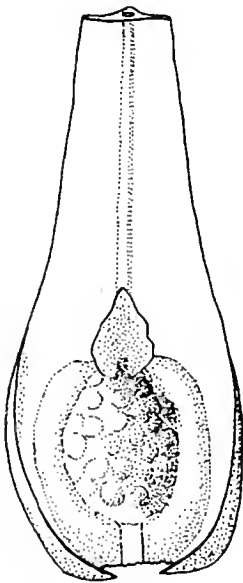


LEAVES 2-10(-15) cm long, 0.5-2 mm wide, linear or slightly tapering from the base to a blunt but narrow point, often arcuate, triangular in cross-section with the upper side flattened, with a single longitudinal air canal, lacking the septa seen in the air chambers of the other species; green, although somewhat translucent towards the base.

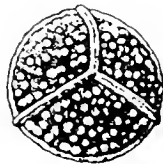
LEAF-BASE spatulate with a broad translucent margin which continues up the leaf for 1-2 cm; **the area bearing the sporangium becoming black and hardened at the base and persisting for some years as a horny cusp**, cradling sporangia and protecting the corm from routing herbivores.



HABIT: A terrestrial rosette-forming plant with leaves arising from a 3-lobed, corm-like stem, appearing very early in the year (February/March) and (regardless of the availability of water) that will die back to the corm by the end of April or mid May; in exposed conditions leaves will lie flat and merge with other associated species, in less exposed and marshy conditions, leaves are erect and rush-like.



FERTILE LEAVES
produced later in the
growing season (April).



SPORANGIUM containing
either mega- or microspores.

MEGASPORES
350-470 μm , with fine,
frequently coalescing
warts (x 50).

HABITAT: In areas which retain water during the winter or which have a steady flow of ground water during that time, but which also dry out in the summer; often on S- or SW-facing maritime cliff tops, on gentle valley slopes facing the sea, or in imperceptible hollows at sea-level; usually on shallow silty or peaty soils over serpentine or granite.

DISTRIBUTION: A Mediterranean species that spreads up the Atlantic seaboard to the Channel Islands (Guernsey and Jersey) and to the Lizard Peninsula.

CONSERVATION STATUS: A very local species in Britain but well documented and known to be in some quantity where it grows. Most sites are in protected areas.

COMPARE WITH:

There is no other species of terrestrial quillwort with which it can be confused in Britain but it can be mistaken for a number of maritime turf plants like the spring squill (*Scilla verna*), young sea thrift (*Armeria maritima*) and, in the Channel Islands, the sand crocus (*Romulea columnae*) that have similar leaves. None, however, have a large longitudinal canal in the leaf or the characteristic horny leaf-bases of *I. hystrix*.

11-19 The Horsetails

Equisetaceae: *Equisetum*

Introduction

These curious plants are the relicts of an ancient family known through fossils from as early as 325 million years ago, the geological period (Upper Carboniferous) when the remains of plants became the vast coal deposits that we use today.

Characteristics of Equisetum

Long-creeping, underground rhizome producing aerial stems at close intervals and forming a colony; aerial stems with hollow internodes, the size of the hollow and the arrangement of the different tissues and canals when seen in transverse section being diagnostic for species; surface ridged longitudinally; silica deposited in the epidermis (in sometimes diagnostic patterns); stems appearing jointed, with leaves in whorls and reduced and fused into a sheath at the stem nodes, the number of leaves equals the number of stem ridges; branches absent or produced at the nodes; fertile stems emerging before sterile ones, similar or dissimilar to sterile stems, with an apical cone composed of whorls of hexagonal, peltate sporangiophores bearing sporangia; spores green, each with four hygroscopic strap-like structures called 'elators'.

NOTE: 'feel' by gently squeezing the stem internode; assess 'rough/smooth' by running a fingernail down the stem internode.

Field key to species

- | | | |
|---|--|----------------|
| 1 | Stem not green, never branched with a cone at apex, only fertile stems present | 2 |
| 1 | Stem green, with or without cone and/or branches (or if stem white then with dense whorls of green branches) | 3 |
| 2 | Stem with few (4-6) sheaths, cone 1-4 cm long | arvense (15) |
| 2 | Stem with many (6-12) sheaths, cone 4-10 cm long | telmateia (19) |
| 3 | Branches present, few, or many in a whorl | 4 |
| 3 | Branches absent | 11 |
| 4 | Stem internodes white, c. 1 cm diam. | telmateia (19) |
| 4 | Stem internodes green, less than 1 cm diam. | 5 |

- 5 Branches again branched; sheath teeth with a broad russet-brown scarious margin, adhering together **sylvaticum** (17)
- 5 Branches not branched; or if so, the sheath teeth without scarious margins 6
- 6 Lowest branch internode equal to or longer than adjacent stem sheath 7
- 6 Lowest branch internode shorter than adjacent stem sheath at lower nodes 8
- 7 Stem smooth, sheath teeth lacking scarious margin **arvense** (15)
- 7 Stem rough, sheath teeth with broad, white, scarious margin **pratense** (16)
- 8 Sheath teeth with broad, white, scarious margin 9
- 8 Sheath teeth with scarious margin very narrow or lacking 10
- 9 Branches only at base of stem; stem internodes rough, with angular ridges (x 10); stomata visible (x 10) as a single row of white dots either side of each trough between stem ridges **variegatum** (13)
- 9 Branches throughout length of stem; stem internodes smooth, with rounded ridges; stomata visible (x 10) as white dots scattered in each trough between stem ridges **palustre** (18)
- 10 Stem smooth, collapses easily when squeezed **fluviatile** (14)
- 10 Stem slightly rough, feels firm **ramosissimum** (12)
- 11 Stem very rough, sheath teeth shed leaving crenelated upper margin to sheath **hyemale** (11)
- 11 Stem smooth or slightly rough, sheath teeth persistent 12
- 12 Stem collapses easily when squeezed, no dark band developing at base of sheath **fluviatile** (14)
- 12 Stem firm, dark band developing at base of sheath 13
- 13 Sheath teeth with scarious margin narrow or lacking **ramosissimum** (12)
- 13 Sheath teeth with broad, white, scarious margin **variegatum** (13)

Hybrids

For a list of, and notes on, hybrid horsetails, see p. 46.

11 Rough Horsetail

Equisetum hyemale L.



STERILE STEM 70-100 cm x 3-6 mm diam., **very rough, overwintering, unbranched.**

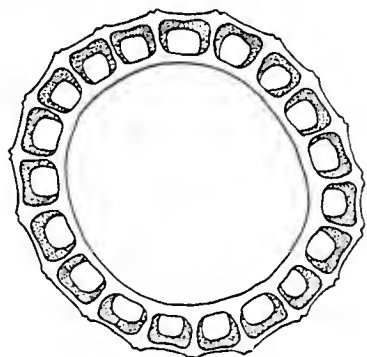
FERTILE STEM similar to sterile one and emerging at same time.

CONE 7-15 mm, **apex sharply pointed**, partly concealed by teeth of uppermost sheath.



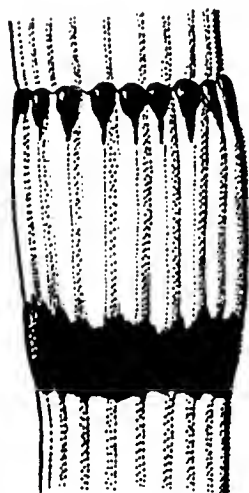
SPORES shed late winter to early spring the year after the cone was formed.

HABIT: Plant forming dense, and often extensive, colonies from an underground rhizome; wintergreen, but young shoots will die in hard frosts.



STEM with 10-30 ridges;
stem feels soft, hollow
 $\frac{2}{3}$ - $\frac{3}{4}$ diam.

SHEATH green at first,
becoming pinkish-grey in
middle and eventually
with a black band at base
that broadens with age.



SHEATH TEETH lost as
stem expands, leaving a
dark, crenelated upper
margin to sheath and a
'pagoda' of whorls of
teeth at stem apex.

INTERNODES become
inflated so that stem
seems narrowed above
and below sheaths.

HABITAT: Lowland wet valley sides and riverbanks with mineral-
and base-rich substrate.

DISTRIBUTION: Throughout the British Isles, but scattered
and scarce south of the Mersey-Humber line.

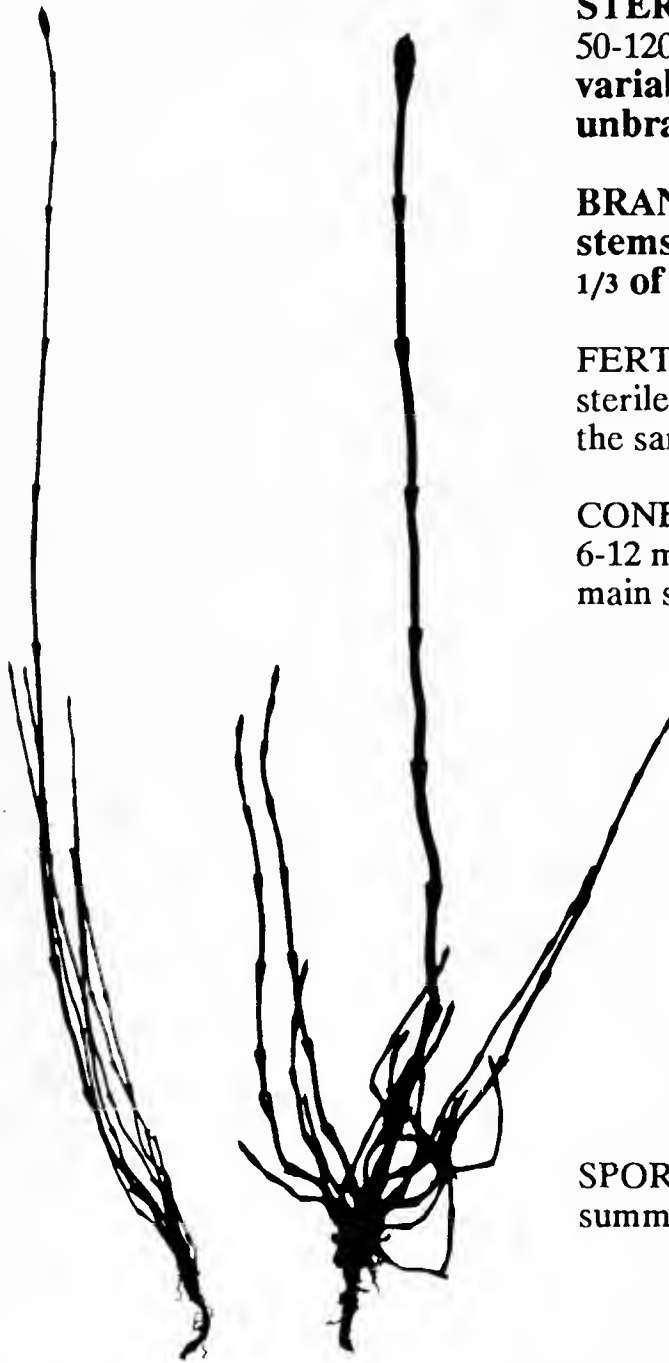
CONSERVATION STATUS: Vulnerable to drainage and
increased grazing pressure.

COMPARE WITH:

(14) **E. fluviatile**, which has a smooth stem and
persistent sheath teeth.

12 Branched Horsetail

Equisetum ramosissimum Desf.



STERILE STEM

50-120 cm x 3-9 mm, **very variable, branched or unbranched.**

BRANCHES on aerial stems mainly in centre 1/3 of stem, upcurved.

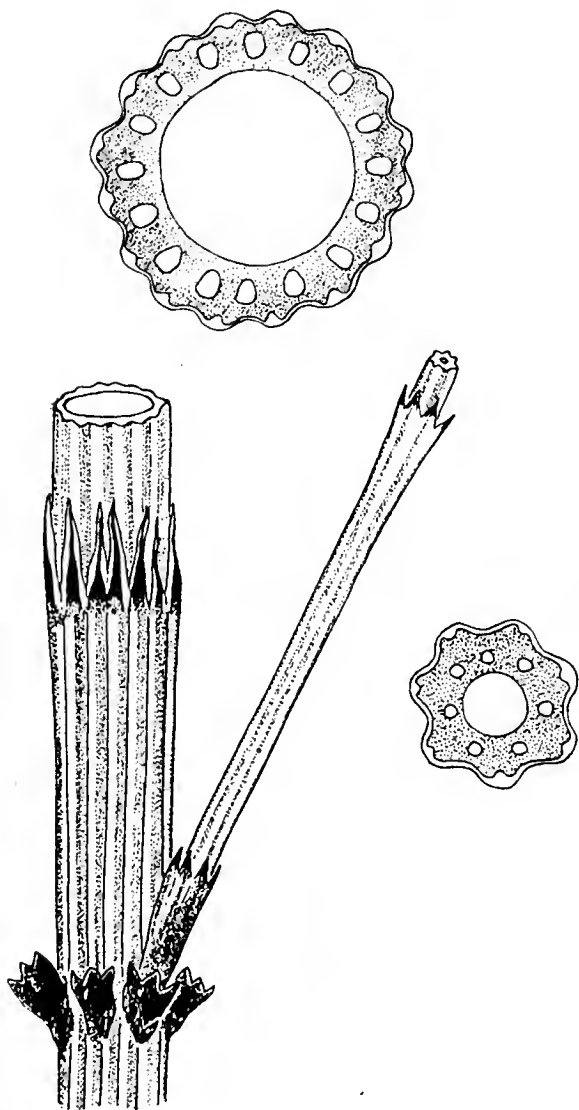
FERTILE stem similar to sterile one and emerging at the same time.

CONE apex sharp-tipped, 6-12 mm, usually only on main stem.



SPORES shed early to late summer.

HABIT: Plant often forming a colony of erect shoots from a branched underground rhizome; tufted appearance from strong branching at base of shoots when in restricted rocky habitats; wintergreen but often dying in second year.



STEM green, with 10-20 distinct ridges, slightly rough; stem feels firm, hollow $\frac{1}{2}$ - $\frac{2}{3}$ diam.

SHEATH TEETH black, with scarious margin very narrow or lacking, very long (up to 5 mm) and pointed, persistent, dark band develops at base.

BRANCH INTERNODE 6-10 angled in TS, 0.5-1 mm wide.

BRANCH TEETH \pm straight, long and pointed, dark.

LOWEST BRANCH INTERNODE much shorter than adjacent stem sheath.

HABITAT: In rough grassland on well-drained sandy soil, not far from sea.

DISTRIBUTION: Only two sites known in the British Isles; definitely introduced with ballast in Lincolnshire.

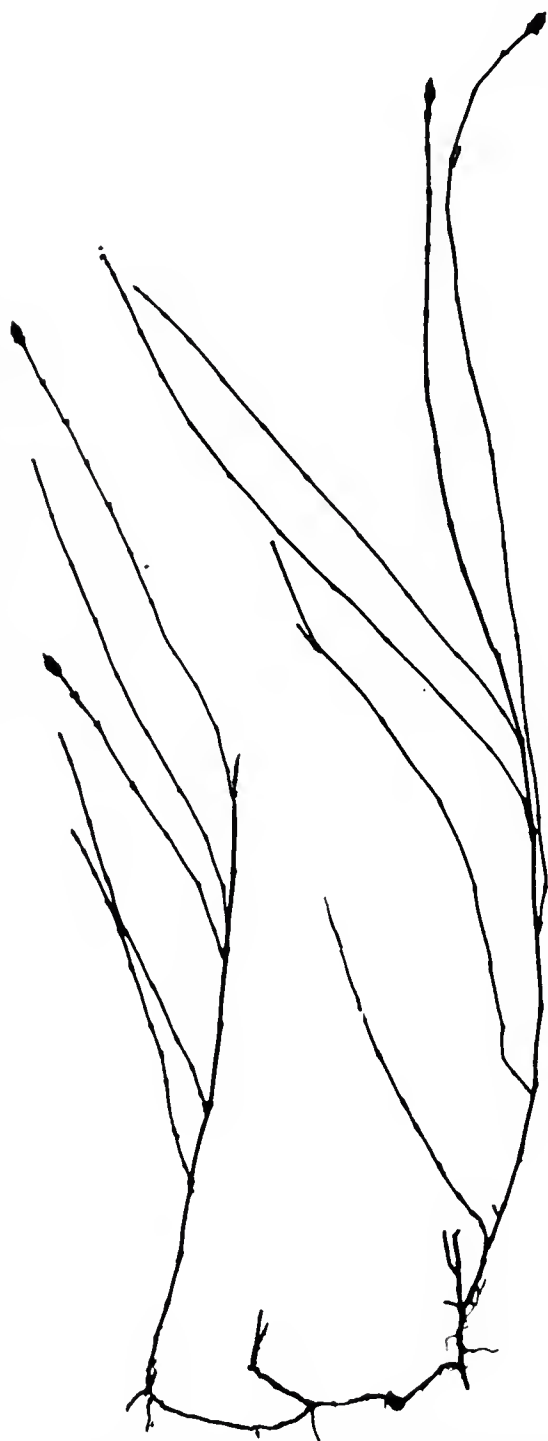
CONSERVATION STATUS: The Lincolnshire site is threatened by flood protection schemes but the species is protected under the *Wildlife and Countryside Act, 1981*.

COMPARE WITH:

(13) *E. variegatum*, which has shorter sheath teeth with broad, scarious margins.

13 Variegated Horsetail

Equisetum variegatum Schleicher ex Weber & Mohr



STERILE STEM 5-60 cm x 1.5-2 mm diam., (or up to 80 cm x 3 mm in robust forms which are frequently found in Irish fens); **main stem decumbent, often branched at base, rarely branched above and if so then usually only one branch at a node.**

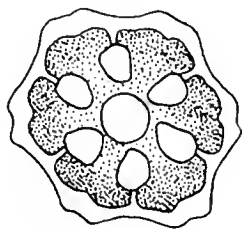
FERTILE STEM similar to sterile one and emerging at same time.

CONE sharply pointed, 5-7 mm.

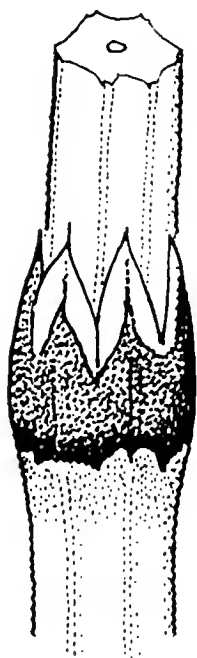


SPORES shed late spring to early summer.

HABIT: Plant bearing decumbent, prostrate or erect shoots from an underground rhizome, forming small, but often dense, colonies; wintergreen.



STEM with 6-8 angular ridges, slightly rough; stem feels firm, hollow c. 1/3 diam.; stomata visible (x 10) as a single row of white dots either side of each trough between stem ridges.



SHEATH TEETH persistent, with a broad, white, scarious margin and a dark mid-line ending in a dark hair-point which is soon lost; black band develops at base of sheath teeth; nodes and internodes may be orange-tinted.

HABITAT: In open, fairly basic, damp sandy sites from lowland heaths and dune-slacks, on alluvial terraces beside mountain streams to high mountain ledges; 0- over 900 m (3000 ft) alt.

DISTRIBUTION: Widespread but uncommon.

CONSERVATION STATUS: Not unduly threatened.

COMPARE WITH:

(18) **Equisetum palustre**, which may produce basal branch shoots of similar appearance (especially if grazed), but these are smooth.

14 Water Horsetail

Equisetum fluviatile L.



STERILE STEM 100-150 cm x 2-8 mm diam., very variable in size and number of branches; form in open sites unbranched, that in shady sites with a few, short upcurved branches in whorls in middle 1/3 of stem.

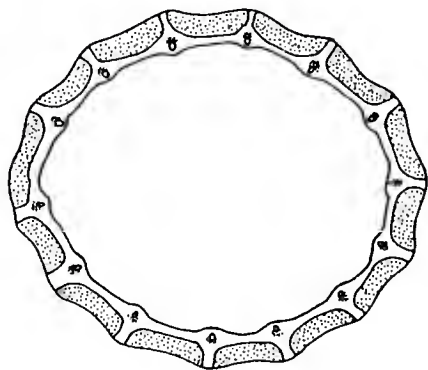
FERTILE STEM shorter than sterile stem and emerging at same time, branches developing later in upper 1/3 of stem.

CONE blunt-tipped, 10-20 mm.



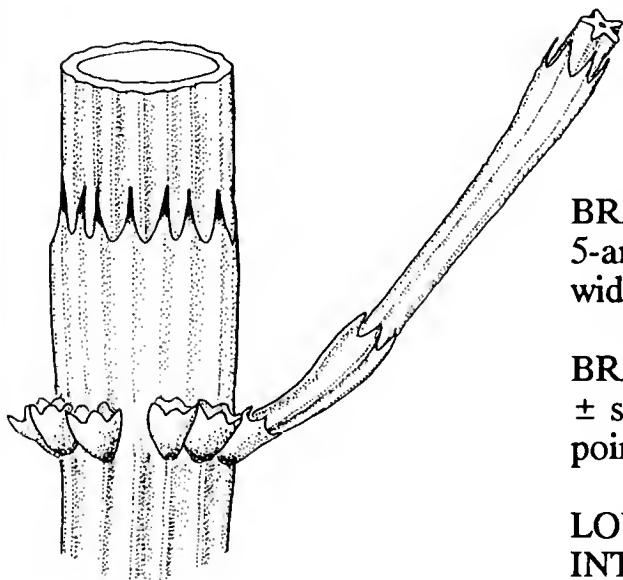
SPORES shed early to mid summer.

HABIT: Plants forming large colonies of erect shoots from a wide-creeping underground rhizome; wintergreen.



STEM with 10-30 very indistinct ridges; collapsing easily when squeezed, hollow $\frac{4}{5}$ or more diam.

SHEATH TEETH persistent, needle-like, brown, occasionally with a very narrow, scarious margin, mostly free, occasionally 2 adhering at margins; sheath tinged with orange.



BRANCH INTERNODE 5-angled in TS, 0.5-1 mm wide.

BRANCH TEETH \pm straight, black, short, pointed.

LOWEST BRANCH INTERNODE shorter than adjacent stem sheath.

HABITAT: In wet ditches, slow-flowing rivers, marshes, alluvial mires, forming the dominant member (or with *Carex rostrata*) in the succession to colonise open water in upland acid lakes; tolerant of up to 1.5 m water.

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(15 x 14) *E. x litorale*, which has a much firmer shoot, i.e. the central cavity is much smaller.

15 Field Horsetail

Equisetum arvense L.



STERILE STEM

10-90 cm x 3-5 mm diam., green, branched.

BRANCHES whorled, many and unbranched (or very rarely branched again), upcurved.

FERTILE stem 10-25 cm, emerging earlier than sterile stem and very short-lived, whitish-brown, unbranched; sheaths 4-6, large, chaffy.

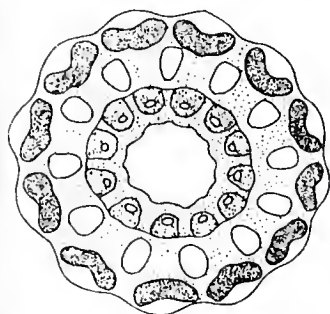
CONE blunt-tipped, 10-40 mm.



SPORES shed late spring/early summer.

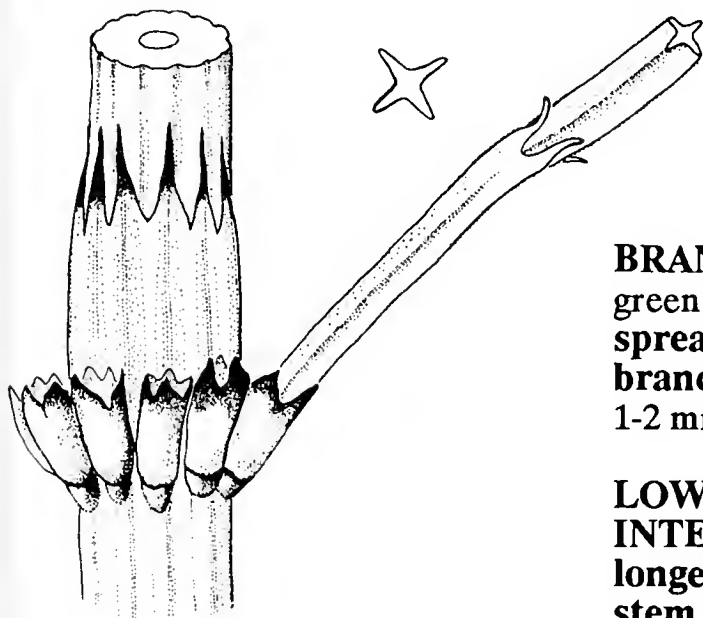


HABIT: Plant forming a colony of erect stems in sheltered sites or prostrate stems in exposed sites, from an underground rhizome; dying down in winter.



STEM with 8-20 ridges, smooth, stem feels firm, hollow less than 1/2 diameter.

SHEATH TEETH persistent, black tips, no scarious margin.



BRANCH INTERNODE 4-armed in TS, 1-2 mm wide.

BRANCH TEETH usually green throughout, spreading away from branch axis, free part 1-2 mm long.

LOWEST BRANCH INTERNODE equal to or longer than adjacent stem sheath.

HABITAT: Fields, hedge banks, waste land and gardens; mainly on sandy soils but also seen on river gravels and in peaty high-altitude flushes.

DISTRIBUTION: Common throughout the British Isles; an almost uneradicable weed.

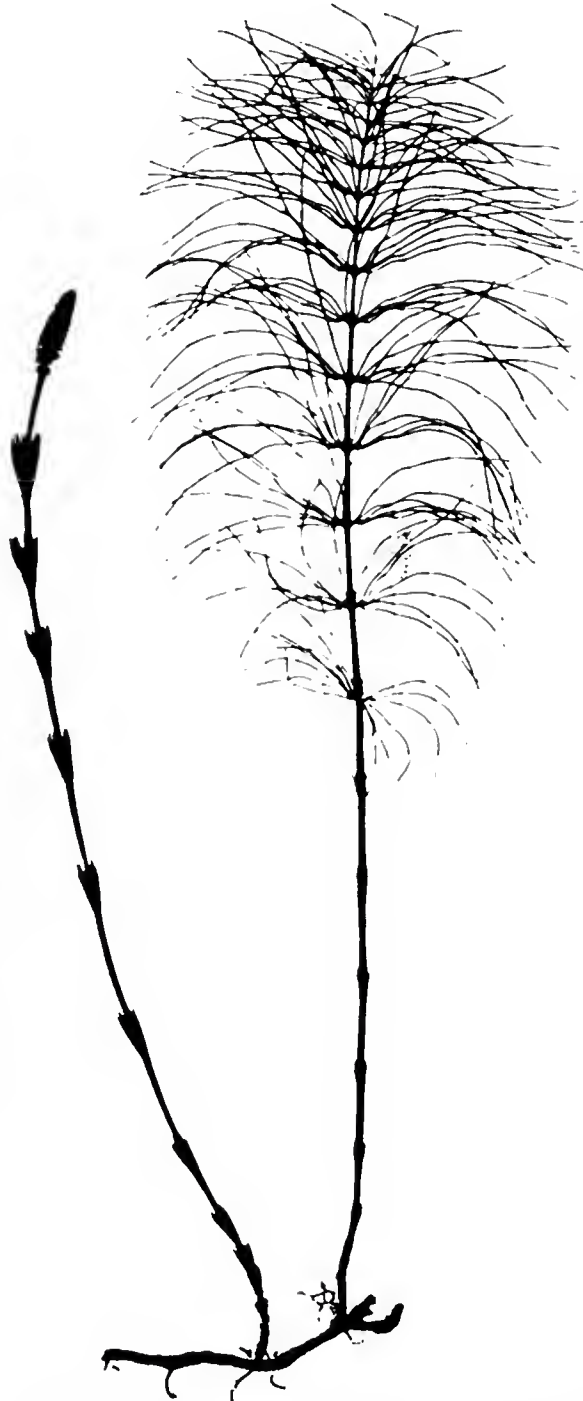
CONSERVATION STATUS: Not threatened.

COMPARE WITH:

- (16) *E. pratense*, which has a very rough stem;
- (17) *E. sylvaticum* fertile stems may lack branches and look very similar to *E. arvense*, but may be distinguished by having groups of sheath teeth attached along their margins;
- (18) *E. palustre*, noting especially lowest branch internode length.

16 Shade Horsetail

Equisetum pratense Ehrh.



STERILE STEM

10-30 cm x 1-3 mm, pale, almost glaucous green; outline blunt-topped or rounded when fully expanded.

BRANCHES many, unbranched, slender, flexed down.

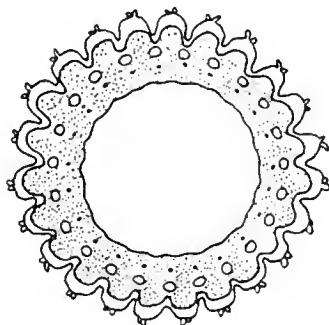
FERTILE STEM 10-35 cm, sheaths numerous, stem initially green and unbranched, then either withers when spores shed, or produces whorls of branches and resembles sterile stem.

CONE rare, blunt-tipped, 15-20 mm.



SPORES shed early summer.

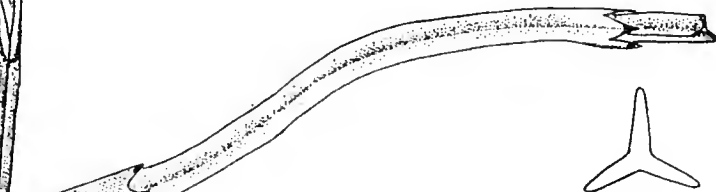
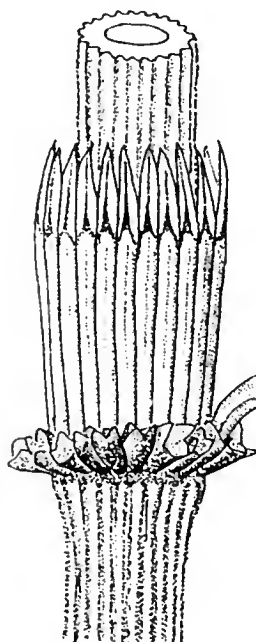
HABIT: Plant producing erect stems from a wide-creeping rhizome, forming colonies; dying down in winter.



STEM with 8-20 ridges, **very rough**, feels very firm, hollow c. 1/2 diameter.

SHEATH TEETH persistent, with a **black centre** and a **conspicuous broad, white, scarious margin**.

BRANCH TEETH often brown tipped, free part 0.5 mm, adpressed to branch axis.



BRANCH INTERNODE 3-armed in TS, 0.5-1 mm wide.

LOWEST BRANCH INTERNODE very much shorter than adjacent stem sheath at lower nodes, but longer at upper nodes.

HABITAT: Undisturbed stream and river banks with light shade, occasionally in open moorland at higher altitudes where drainage or spring water percolates, in wet flushes in woodland; requires some calcium and base-rich salts.

DISTRIBUTION: Not common, in scattered localities in Scotland, N Ireland and N Pennines of England.

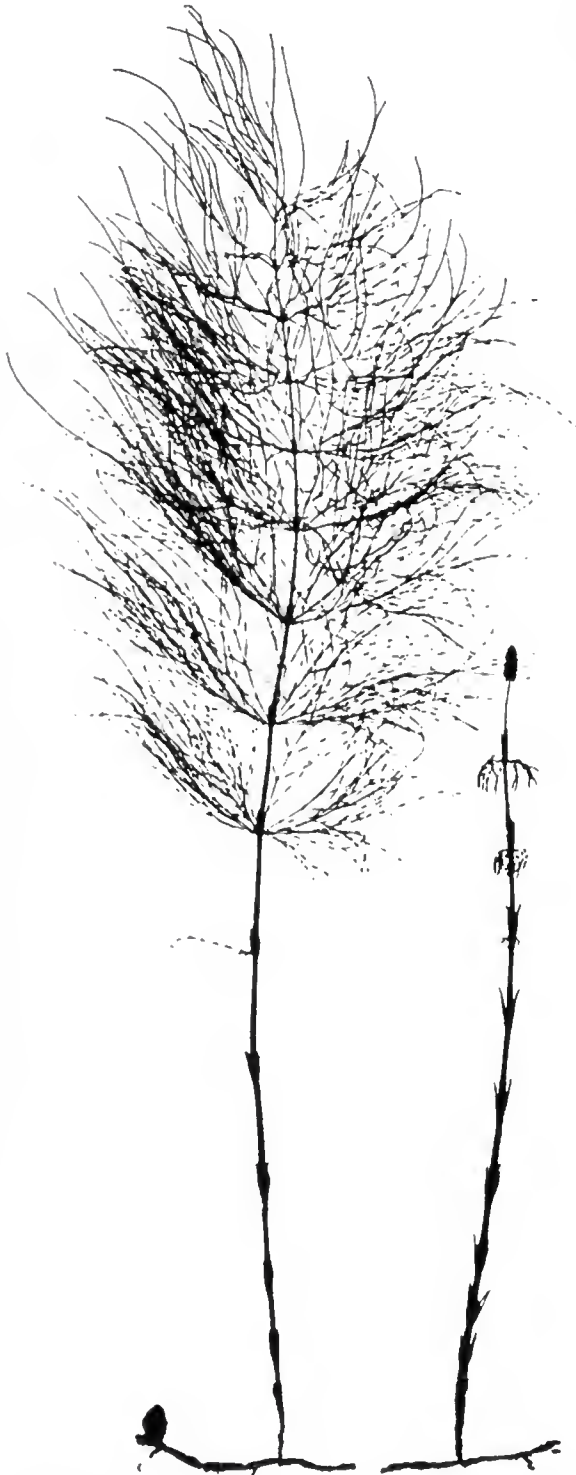
CONSERVATION STATUS: Vulnerable in its lowland sites due to afforestation.

COMPARE WITH:

- (15) *E. arvense*, which feels smooth and lacks the scarious margin on the sheath teeth; also see branch TS;
- (17) *E. sylvaticum*, which has spreading branch teeth and branched branches; and see also branch TS.

17 Wood Horsetail

Equisetum sylvaticum L.



STERILE STEM 10-50 cm (occasionally larger in lush sites) x 3-6 mm diam., green.

BRANCHES many, branched, gracefully drooping, grass-green.

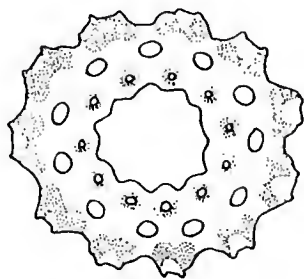
FERTILE STEM as tall as, and emerging at same time as sterile shoots, whitish, with numerous sheaths, but initially no branches; whorls of branches produced as cone matures, finally resembles sterile stem.

CONE blunt-tipped, 15-25 mm.



SPORES shed late spring/early summer

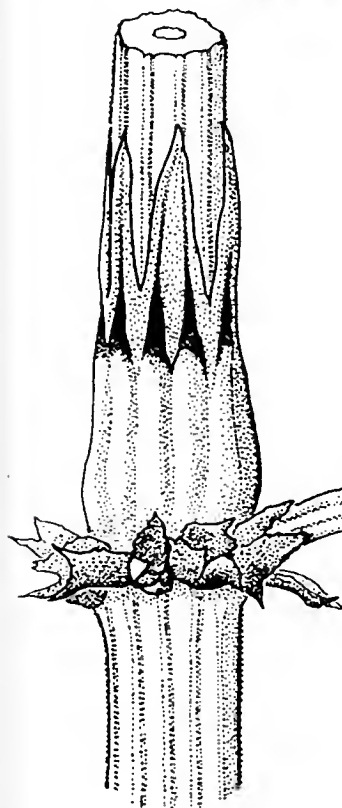
HABIT: Plant producing often large stands of erect stems from an underground much-branched rhizome; dies down in winter.



STEM with 10-18 ridges, each main ridge topped by two small ridges of silica, smooth to fairly rough, feels firm, hollow $\frac{1}{4}$ - $\frac{1}{3}$ diam.

SHEATH TEETH
persistent, thin, dark central stripe with a very broad, russet-brown, scarious margin, attached at margins into groups of 2 or 3.

BRANCH INTERNODE 3(-4)-armed in TS, 0.5-0.6 mm wide.



BRANCH TEETH c. 1 mm long, slightly spreading, green, slender, acutely pointed.

LOWEST BRANCH INTERNODE always longer than adjacent sheath.



HABITAT: On humid, sheltered moorland stream banks and wet woodlands, especially conifer plantations in western areas of high rainfall.

DISTRIBUTION: Widespread, becoming more scattered in the drier eastern part of Britain.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(15) *E. arvense*, which has simple branches 1-2 mm wide;

(16) *E. pratense*, which has unbranched branches and broad, white, scarious margins to the sheath teeth.

18 Marsh Horsetail

Equisetum palustre L.



STERILE STEM typically
15-50 cm long x
1-3 mm diam. (but a stunted
form c. 10 cm, with very few
branches occurs in high
altitude mountain flushes).

BRANCHES few,
upcurved, unbranched.

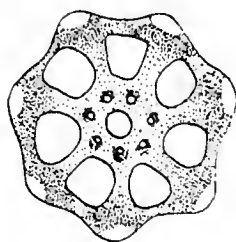
FERTILE STEM similar to
sterile one, emerging at
same time.

CONE blunt-tipped,
15-25 mm.

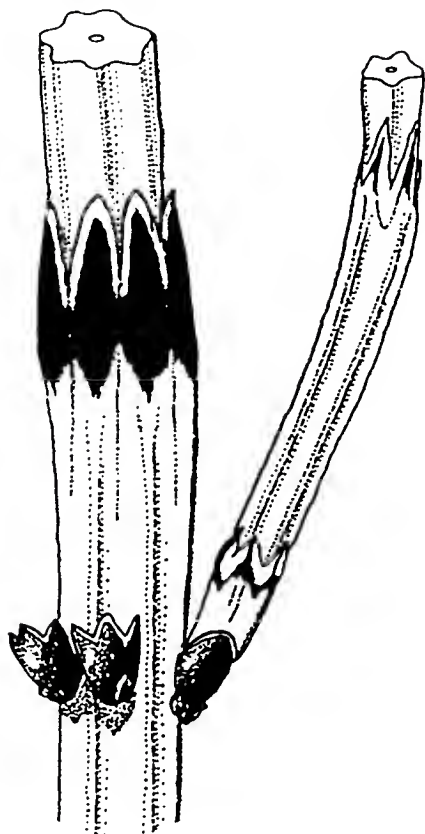


SPORES shed in summer.

HABIT: Plant bearing erect shoots from an underground rhizome;
usually dying down in winter.



STEM very smooth, with 5-9 ridges; stem feels very firm, hollow less than $\frac{1}{4}$ diameter, stomata visible as white dots scattered in each trough between stem ridges (x 10).



SHEATH TEETH persistent, black, with a conspicuous broad, white, scarious margin surrounding the central 'gothic-arch' shaped central black triangle.

BRANCH INTERNODE 4-6 angled in TS, c. 1 mm wide.

LOWEST BRANCH INTERNODE much shorter than adjacent stem sheath.

BRANCH TEETH short, clasping branch axis, usually blackish tipped, with a scarious margin.

HABITAT: In wet or damp places e.g. ditches, marshes, bogs, sand-dunes, verges of metalled roads in acid moorland areas; requires some base-rich salts.

DISTRIBUTION: Widespread in the British Isles.

CONSERVATION STATUS: Not threatened.

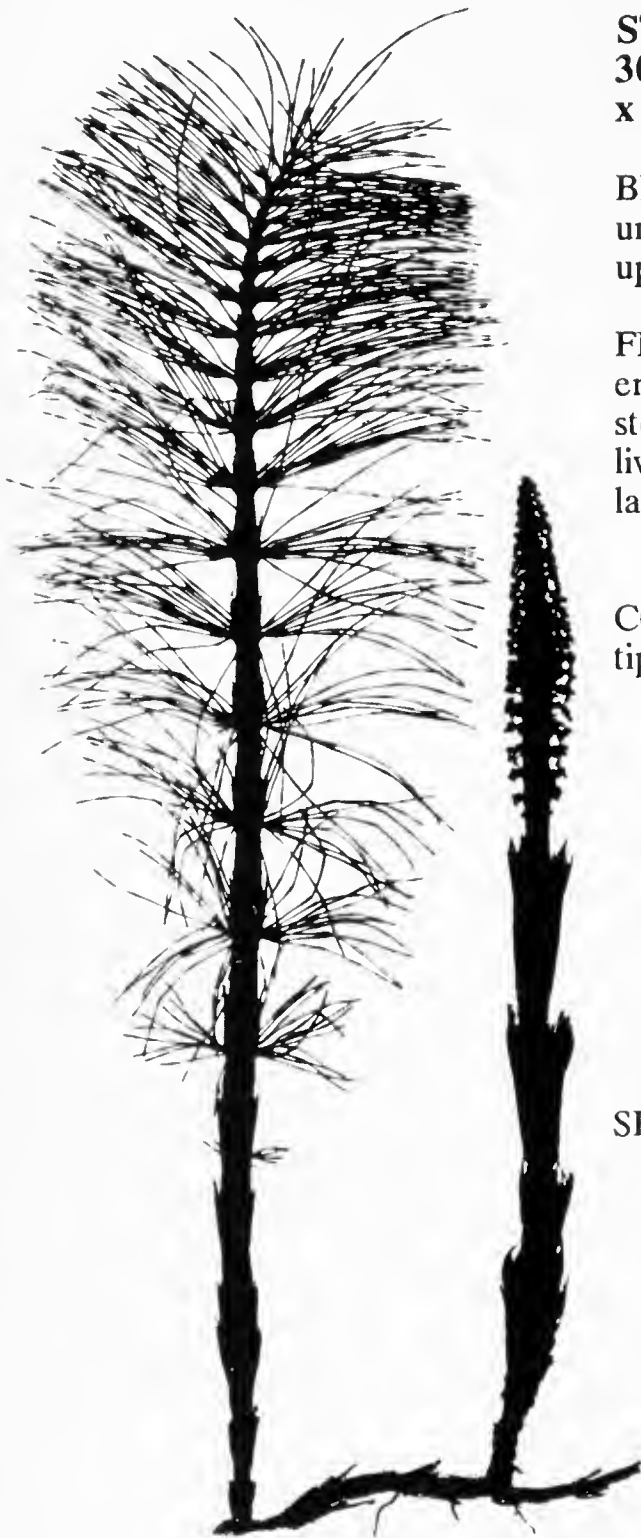
COMPARE WITH:

(15) *E. arvense*, especially in high altitude wet flushes, noting longer lowest branch internode;

(13) *E. variegatum*, which develops a black band at base of sheath teeth.

19 Great Horsetail

Equisetum telmateia Ehrh.



STERILE STEM
30-100 cm or more
x 10-30 mm diam., white.

BRANCHES many,
unbranched, pale green,
upcurved.

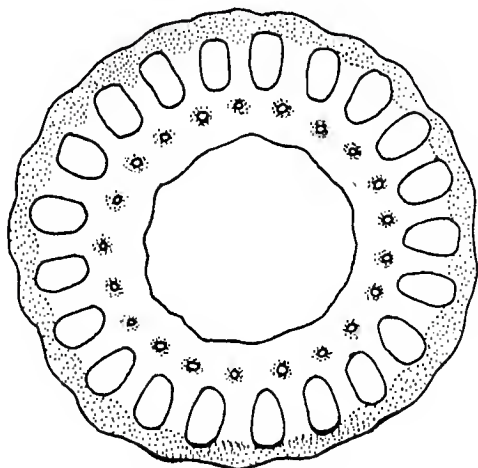
FERTILE STEM 15-25 cm,
emerging earlier than sterile
stem, white, and very short-
lived, sheaths numerous with
large, brown, chaffy teeth.

CONE 50-80 mm, blunt-
tipped.



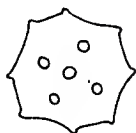
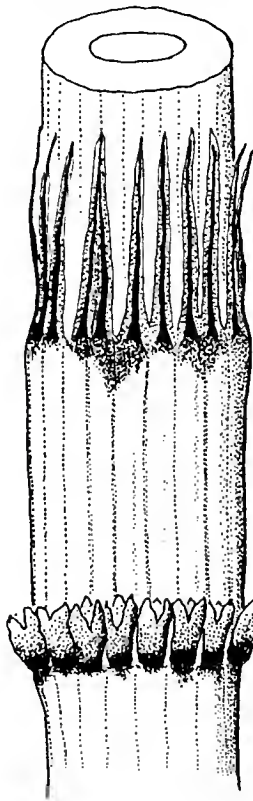
SPORES shed late spring.

HABIT: Plant with erect shoots from a creeping underground rhizome forming large, often dense, colonies; dying down in winter.



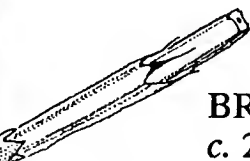
STEM with 20-40 inconspicuous ridges, smooth, easily compressed, hollow $\frac{2}{3}$ or more diameter.

SHEATH TEETH narrow, pale brown, with scarious margins at base, mostly free, but some joined at margins in groups of 2 or 3; sheath grey-green.



BRANCH INTERNODE 0.5 mm wide with 4-5 bi-angled ridges in TS, ridges with very small saw-like teeth (x 20).

LOWEST BRANCH INTERNODE shorter than adjacent stem sheath.



BRANCH TEETH 4-5, c. 2 mm, green, linear-lanceolate, ± straight, adpressed.

HABITAT: On banks, roadsides and in damp, base-rich places.

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

No other British Horsetail can be confused with this species.

11-19 Hybrid Horsetails

The following hybrids (■) have been found in the British Isles:

E. x bowmanii C.N. Page = (17) *E. sylvaticum* x

(19) *E. telmateia*

E. x dycei C.N. Page = (14) *E. fluviatile* x (18) *E. palustre*

E. x font-queri Rothm. = (18) *E. palustre* x (19) *E. telmateia*

E. x litorale Kuhlew. ex Rupr. = (15) *E. arvense* x

(14) *E. fluviatile*

E. x mildeanum Rothm. = (16) *E. pratense* x (17) *E. sylvaticum*

E. x moorei Newm. = (11) *E. hyemale* x (12) *E. ramosissimum*

E. x rothmaleri C.N. Page = (15) *E. arvense* x (18) *E. palustre*

E. x trachyodon A. Braun = (11) *E. hyemale* x

(13) *E. variegatum*

							hye
						ram	■
					var	⚥	■
				flu			
			arv	■			
		pra	⚥				
	syl	■					
pal			■	■			
tel	■	■	⚥				

These hybrids may be formed wherever the parent species grow in reasonable proximity. Shoot fragments may be dispersed and give rise to new colonies elsewhere. *E. x moorei* is known in the British Isles only from Wicklow in Ireland, although one parent, *E. ramosissimum*, is not known from that island. Hybrid horsetails are generally rare and often known only as isolated populations. They show a mixture of morphological characters of both parents and have abortive cones. *E. x dycei* and *E. x litorale* are more commonly found, but are often confused with each other.

Three further hybrids (⚥) involving British species have been recorded for mainland Europe, but two of these (*E. arvense* x *E. pratense* and *E. arvense* x *E. telmateia*) need confirmation. They could be found in suitable situations in the British Isles.

23 Moonwort and Adder's Tongues

Ophioglossaceae

Introduction

These rather fleshy-looking and ungraceful plants are very untypical ferns. They are thought to be members of one of the earliest groups of ferns to have evolved. There is no fossil evidence to support this idea, but it is widely accepted because they show some features common to the early prehistoric plants. Members of this group are the only extant ferns whose young leaves do not have the typical fern habit of developing as a crozier.

Characteristics of Ophioglossaceae

Small terrestrial plants with an underground stem often spreading by means of stolons; leaves fleshy, with two portions, the leaf-blade and a fertile structure (*spike*) arising from the base of that blade, in *Ophioglossum* a simple structure bears a fused, double row of sporangia near the apex, in *Botrychium* a branched structure bears clusters of sporangia like bunches of grapes; sporangia thick-walled and without a row of thickened cells (*annulus*), dehiscing by a horizontal slit to release several thousand spores from each sporangium.

Field key to species

- 1 Blade of leaf with 4-8 pairs of fan-shaped pinnae, spike
1- to 2-pinnate with sporangia terminal on ultimate
segments ***Botrychium lunaria* (20)**
- 1 Blade of leaf not divided, ovate to lanceolate, spike not
divided and the sporangia fused in a double row 2
- 2 Leaves appearing in autumn, dying down in spring, leaf-blade
8-23+ mm long, thick, fleshy or waxy, spores shed in early
spring ***Ophioglossum lusitanicum* (23)**
- 2 Leaves appearing in spring, dying down in summer/autumn,
leaf-blade usually larger, if <20 mm then texture thin,
spores shed in summer 3
- 3 Leaf-blade flat, held erect; leaves arising singly
***Ophioglossum vulgatum* (21)**
- 3 Leaf-blade convex, reflexed and held almost parallel to the
ground; leaves usually arising in pairs
***Ophioglossum azoricum* (22)**

20 Moonwort

Botrychium lunaria (L.) Swartz



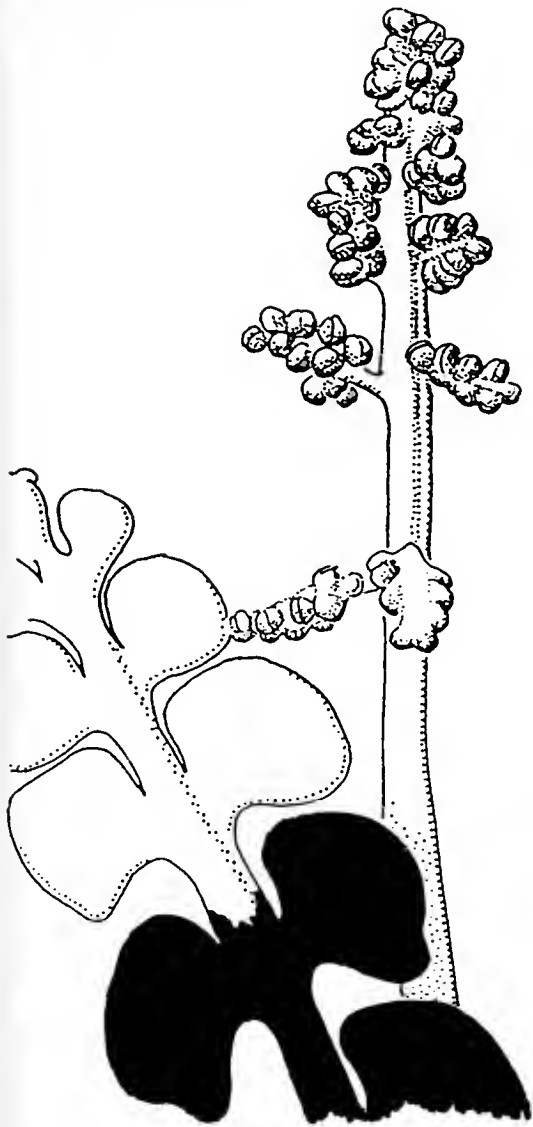
PLANT 5-25 cm, fleshy, with 2 main leaf portions: a sterile portion or leaf-blade, and a fertile portion, the spike.

LEAF-BLADE 2.5-14 cm, held away from the vertical, linear-oblong, **pinnate**, **pinnae 4-8 opposite pairs, fan-shaped, margins entire to deeply crenate; with a single terminal \pm lobed pinna.**

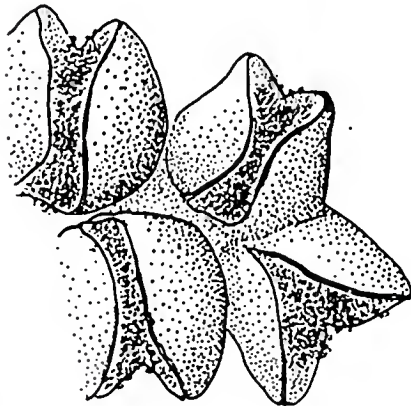
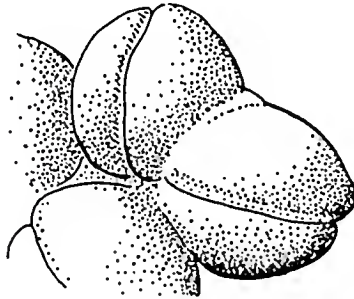
SPIKE shorter to longer than the blade, held vertically, 1- to 2-pinnate.

STIPE succulent, stem-like.

HABIT: Solitary plants arising from an underground, upright rootstock; dies down at the end of the summer and frequently lies dormant for several seasons before re-appearing.



SPORANGIA not arranged in separate sori but occurring along margins of ultimate segments which almost completely lack lamina tissue.



HABITAT: In open places in grassy uplands and old meadows, sometimes in old dune-slacks or mine tips, usually where base-rich conditions are present; from sea-level to c. 1000 m (3350 ft).

DISTRIBUTION: Throughout the British Isles.

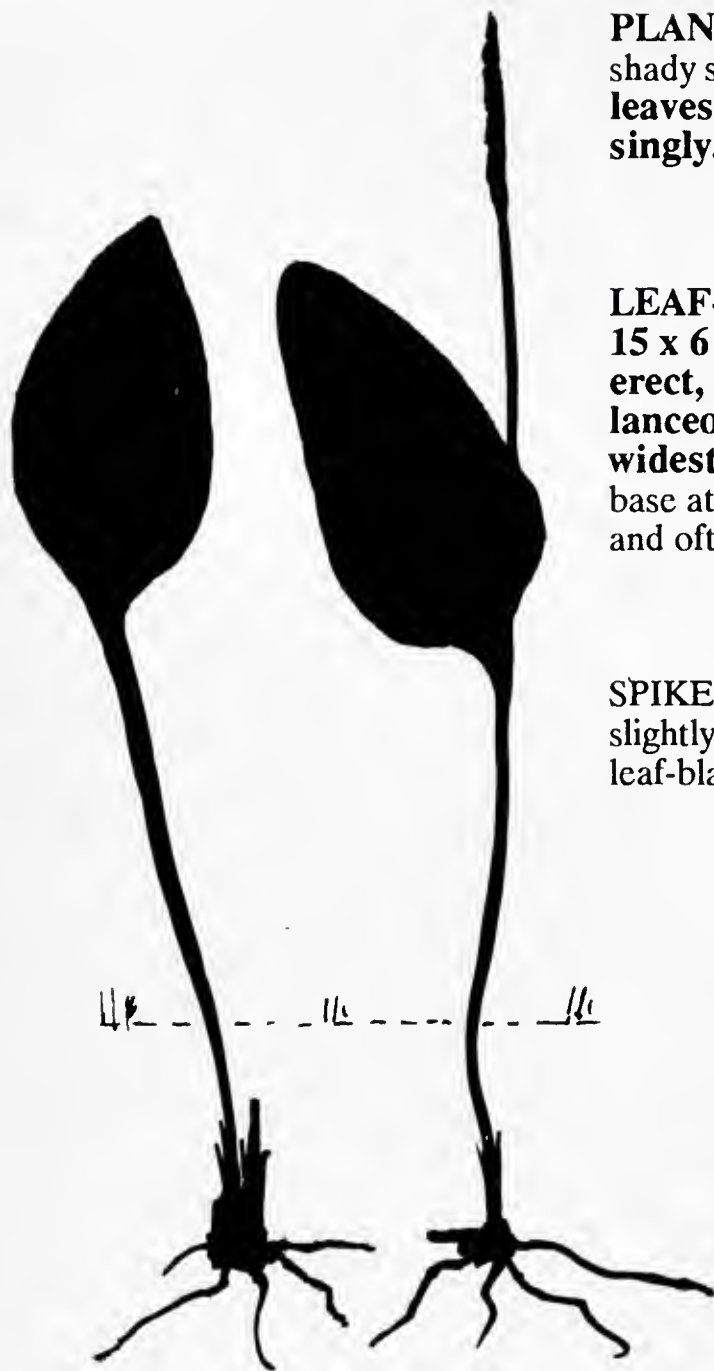
CONSERVATION STATUS: Not threatened.

COMPARE WITH:

This can be confused with no other British pteridophyte. Forms with highly lacerated pinnae have been erroneously recorded as the Central European *B. matricariifolium*, which is unlikely to grow in our oceanic climate.

21 Adder's Tongue

Ophioglossum vulgatum L.

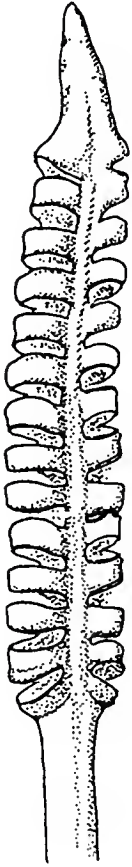


PLANT 8-30 cm, or more in shady situations, fleshy, leaves typically arising singly.

LEAF-BLADE up to 15 x 6 cm, flat, held erect, broadly ovate-lanceolate to ovate, widest below the middle, base attenuate to cordate and often clasping the spike.

SPIKE shorter to slightly longer than the leaf-blade.

HABIT: Plant with an underground rootstock with creeping stolons producing new plants and often forming extensive colonies, emerging in spring and dying back in autumn.



SPORANGIA 11-44.

SPORES released in
summer.

HABITAT: Tolerant of a wide range of soil types; in old damp meadow pastures, chalk downlands, old chalk and marl pits, sand-dune slacks, damp peaty sites, on light sandy soils amongst bracken and in woods, copses and hedgebanks, and on deep peat soils of fenland mowing marshes.

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(22) *O. azoricum*, which typically has two leaves per plant, with the leaf-blades reflexed towards the horizontal; it also appears and dies down earlier in the growing season.

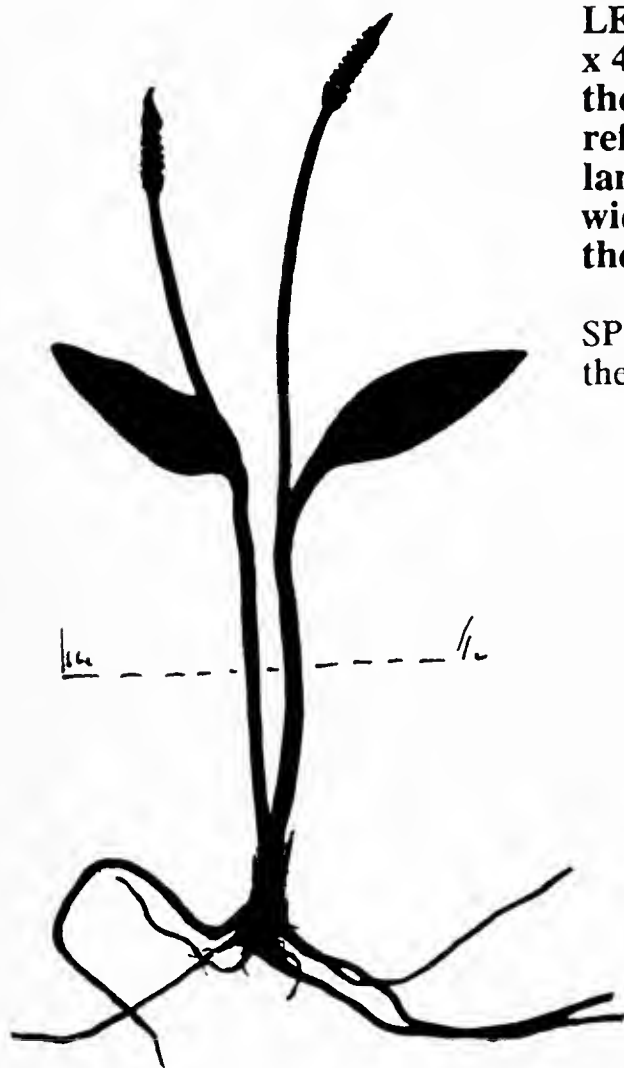
22 Small Adder's-tongue

Ophioglossum azoricum C. Presl

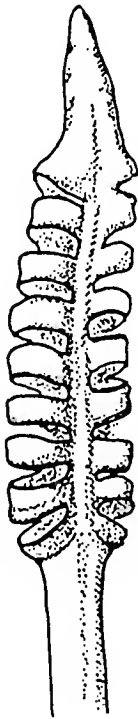
PLANT 3-8 cm, fleshy, leaves typically arising in pairs from an underground rootstock.

LEAF-BLADE 9-22(-40) x 4-10(-14) mm, convex, the apex acute and reflexed, broadly elliptic-lanceolate to ovate, widest at or just below the middle, base cuneate.

SPIKE shorter to longer than the leaf-blade.



HABIT: Plant with an upright underground rootstock with creeping stolons producing new plants and often forming large colonies, emerging in early spring and dying back in summer.



SPORANGIA 4-13(-17).

SPORES released in early summer (May-June).

HABITAT: Short, grazed turf on tops of cliffs and sea crags, and in sand-dune slacks.

DISTRIBUTION: Scattered localities in W and N Britain from the Scilly Isles to Caithness and the Orkneys.

CONSERVATION STATUS: Not immediately threatened, but coastal sites are vulnerable.

COMPARE WITH:

(21) *O. vulgatum* which typically has only one leaf per plant;

(23) *O. lusitanicum* a rarer species known only from a few coastal sites and whose leaves appear in autumn and die down in the spring.

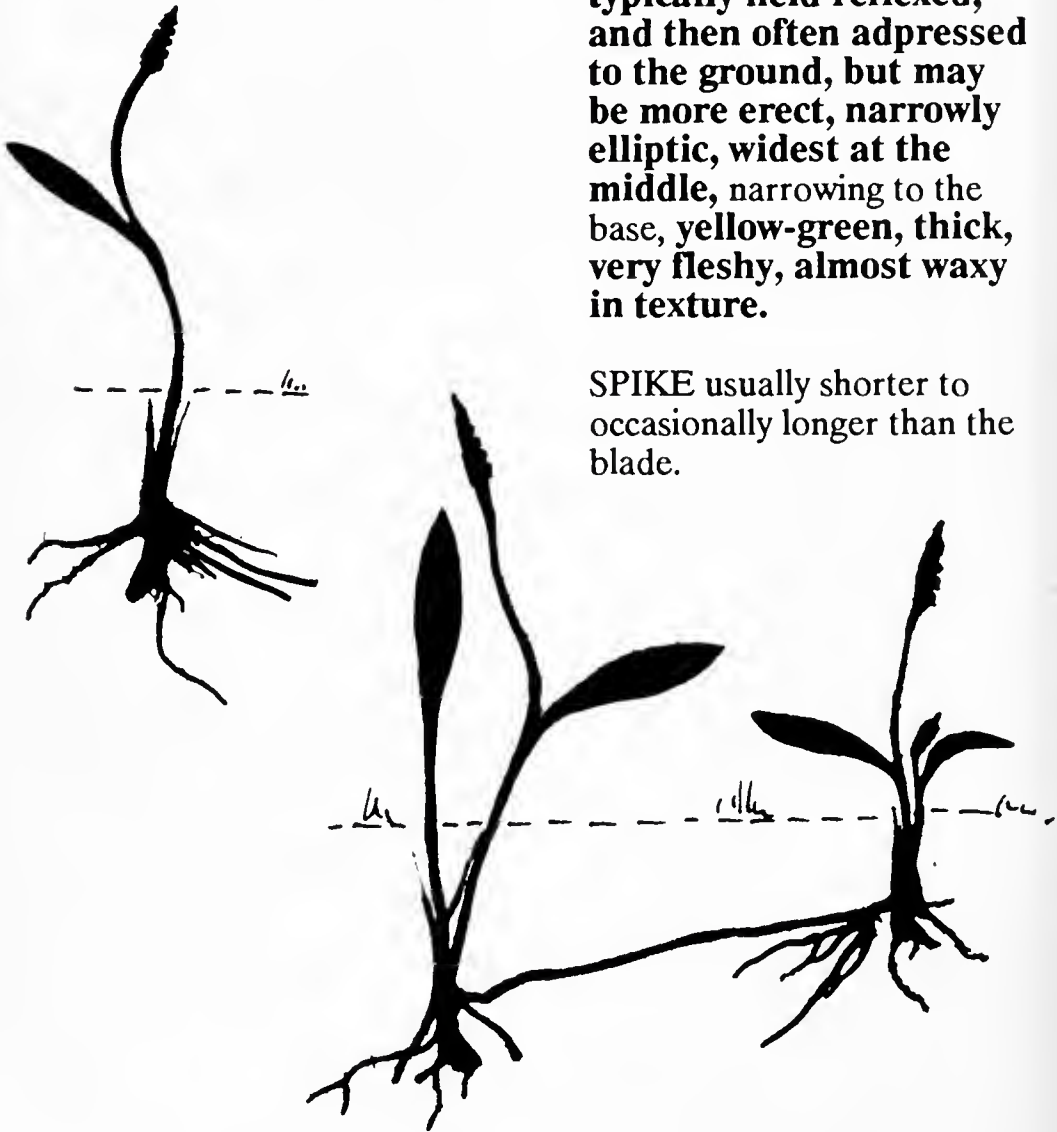
23 Least Adder's Tongue

Ophioglossum lusitanicum L.

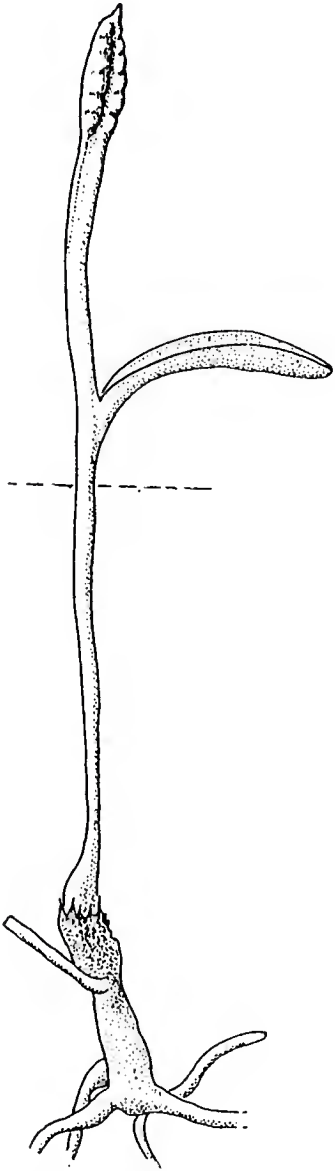
PLANT 1-1.5 cm, fleshy, typically 2 leaves per plant, spreading apart.

LEAF-BLADE 8-23(-38) x 1.5-4(-6) mm long, typically held reflexed, and then often adpressed to the ground, but may be more erect, narrowly elliptic, widest at the middle, narrowing to the base, yellow-green, thick, very fleshy, almost waxy in texture.

SPIKE usually shorter to occasionally longer than the blade.



HABIT: Plant with an underground rootstock with creeping stolons developing new plants and often forming large colonies, emerging in autumn and dying back in spring.



SPORANGIA 3-8(-13) pairs.

SPORES released in early spring (February-March).

HABITAT: In short turf on the moist peaty or sandy soil of relatively exposed, usually S- or SW-facing coastal rock downs and cliff-tops.

DISTRIBUTION: Only a few sites on St. Agnes in the Scilly Isles and Guernsey in the Channel Islands.

CONSERVATION STATUS: Vulnerable because of limited sites. Protected in Britain under the *Wildlife and Countryside Act, 1981*.

COMPARE WITH:

(22) *O. azoricum*, whose leaves are less waxy, broader and emerge in spring and die back in late summer.

24 Royal Fern

Osmunda regalis L.



LEAVES 60-120 (-300) cm, erect, croziers covered with fine matted cinnamon-brown hairs which soon drop away; **fertile leaves bearing, in the upper part, pinnae devoid of lamina to giving a tassel-like appearance.**

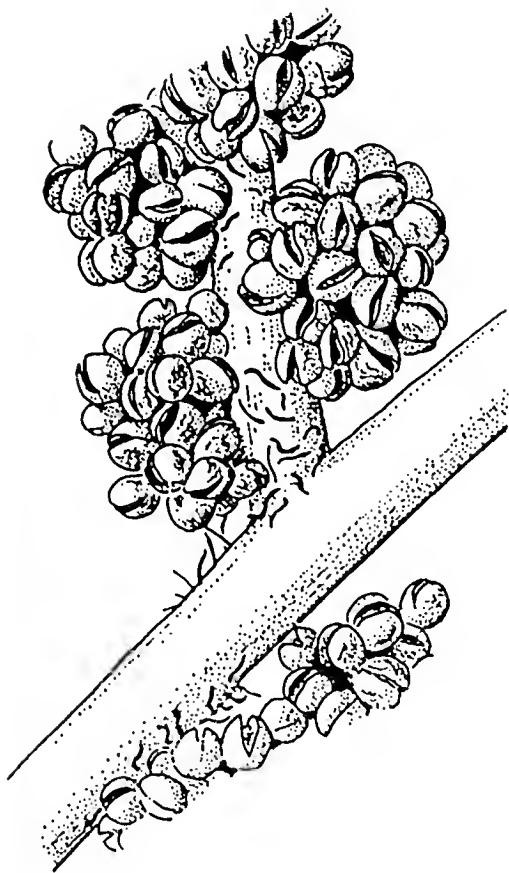
LEAF-BLADE ovate-oblong, 2-pinnate, pale green, texture thin, but tough.

PINNAE up to 50 cm long, linear-oblong.

PINNULES 5-15 cm long, up to 1.5 cm broad, linear, often lobed slightly at the base, apex acute; margins entire, wavy.

STIPE c. 1/2 leaf length, without hairs or scales.

HABIT: Leaves clustered on an erect branching rhizome that eventually forms massive clumps of many crowns; dying down in winter.



SPORANGIA massed along pinnule midribs on very narrow pinnule lamina, pear-shaped, all maturing \pm together and gaping open by an apical slit to release the spores.

SPORES green and short-lived; shed early to mid summer.

NOTE: Because the spores are green, mature fertile leaves appear green; if brown, then the sporangia have already dehisced.

HABITAT: Found in a wide range of acidic wetland habitats from open bogs to wet woodland, ledges of sea cliffs and beside lakes and rivers; at altitudes usually less than 50 m (170 ft), occasionally higher in maritime areas of Ireland.

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: May be locally threatened by drainage.

COMPARE WITH:

Mature plants can be confused with no other British fern but young plants of *Osmunda* may look like (A5) *Onoclea sensibilis*; the veins of this species form a network, those of *Osmunda* are forked and open to the margin.

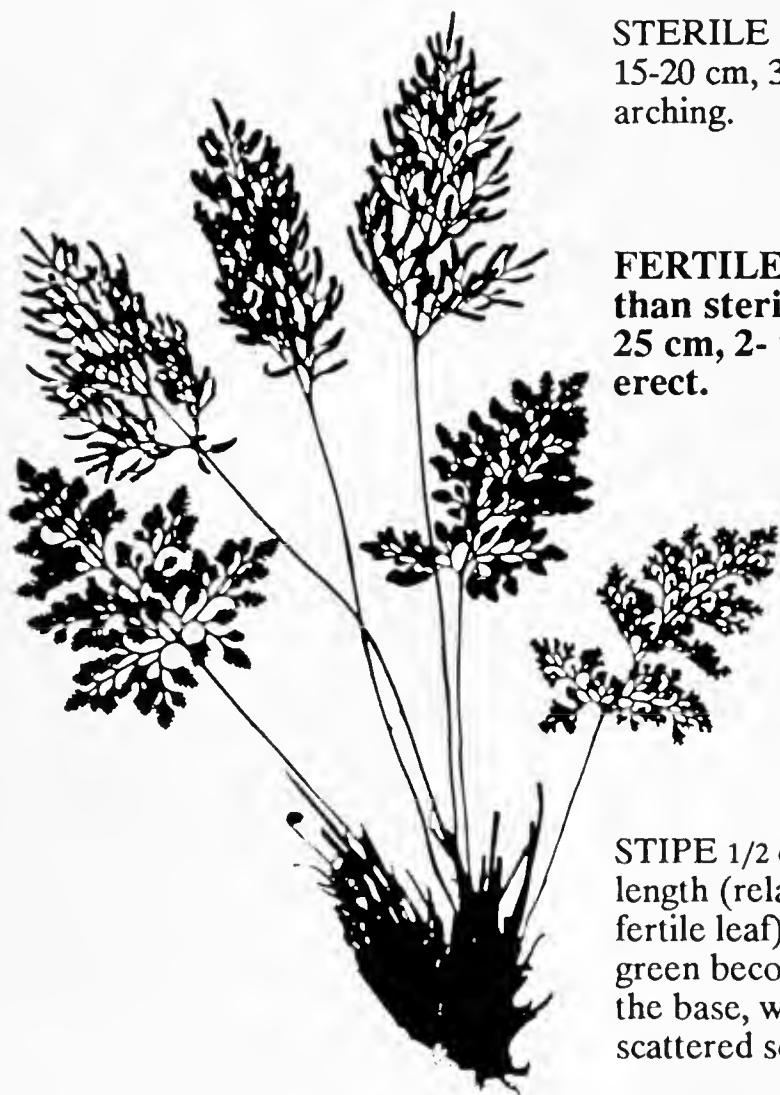
25 Parsley Fern

Cryptogramma crispa (L.) R.Br.

LEAVES ovate-triangular,
bright green, rather leathery.

STERILE LEAVES
15-20 cm, 3-(4-)pinnate,
arching.

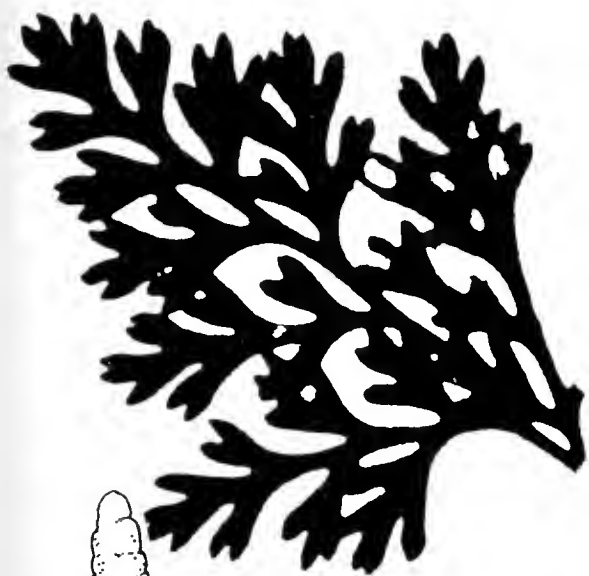
FERTILE LEAVES taller
than sterile leaves, up to
25 cm, 2- to 3-pinnate,
erect.



STIPE 1/2 or more leaf
length (relatively longer in
fertile leaf), slender, brittle,
green becoming brown at
the base, with a few
scattered scales.

SCALES long-triangular,
pale brown.

HABIT: Leaves densely clustered on a branching, semi-erect
rhizome that gives rise to a group of crowns; dying down in the
winter.



STERILE ULTIMATE SEGMENTS broad, wedge-shaped, often overlapping, margin finely toothed.



FERTILE ULTIMATE SEGMENTS linear or linear-oblong, not overlapping, margin rolled under to form a false indusium.

SORI along ends of veins, without a true indusium, protected by inrolled margin of pinnule segment.

HABITAT: Amongst acidic scree and boulders on steep well-drained slopes, drystone walls, occasionally amongst bilberry, from 100-1200 m (300-4000 ft) altitude; a definite calcifuge.

DISTRIBUTION: Common in the Lake District of England, in Wales and Scotland; rare in SW England on the high granite moors, and similarly so in E Ireland.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

No other British fern has this resemblance to Parsley (Umbelliferae).

26 Jersey Fern

Anogramma leptophylla (L.) Link

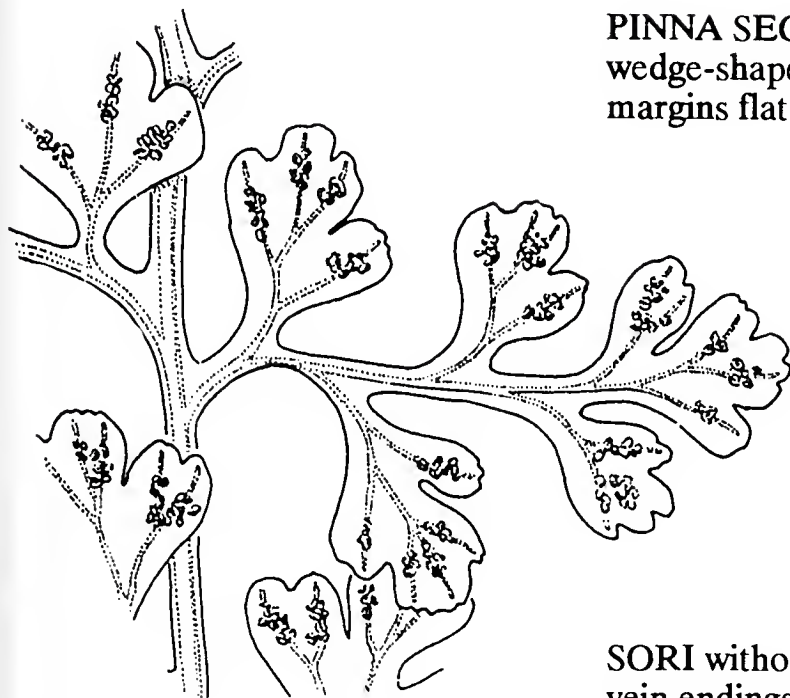
LEAVES up to 18 cm, yellow-green, delicate; the earliest are lax, markedly shorter than later ones, trilobed and sterile, later leaves are held erect, become progressively more dissected reaching 2-pinnate-pinnatifid and are fertile.



STIPE $\frac{1}{2}$ - $\frac{2}{3}$ leaf length, straw-coloured becoming shiny dark brown.

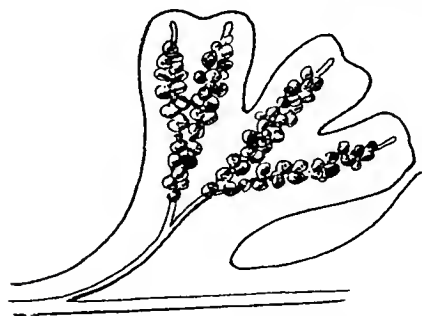
SCALES few, hair-like, 1-cell wide (x 20).

HABIT: Small tufted plants produced annually, frequently from a perenniating gametophyte; sporophyte usually dying during the dry summer period.



PINNA SEGMENTS
wedge-shaped, deeply lobed,
margins flat.

SORI without indusia, along
vein endings and becoming
confluent as they mature.



HABITAT: Open areas of steep, sunny lane sides that are well-drained but catch prevailing rain-bearing winds and where there is little competition from other plants.

DISTRIBUTION: A Mediterranean species that is known from one site in Guernsey and a few in Jersey.

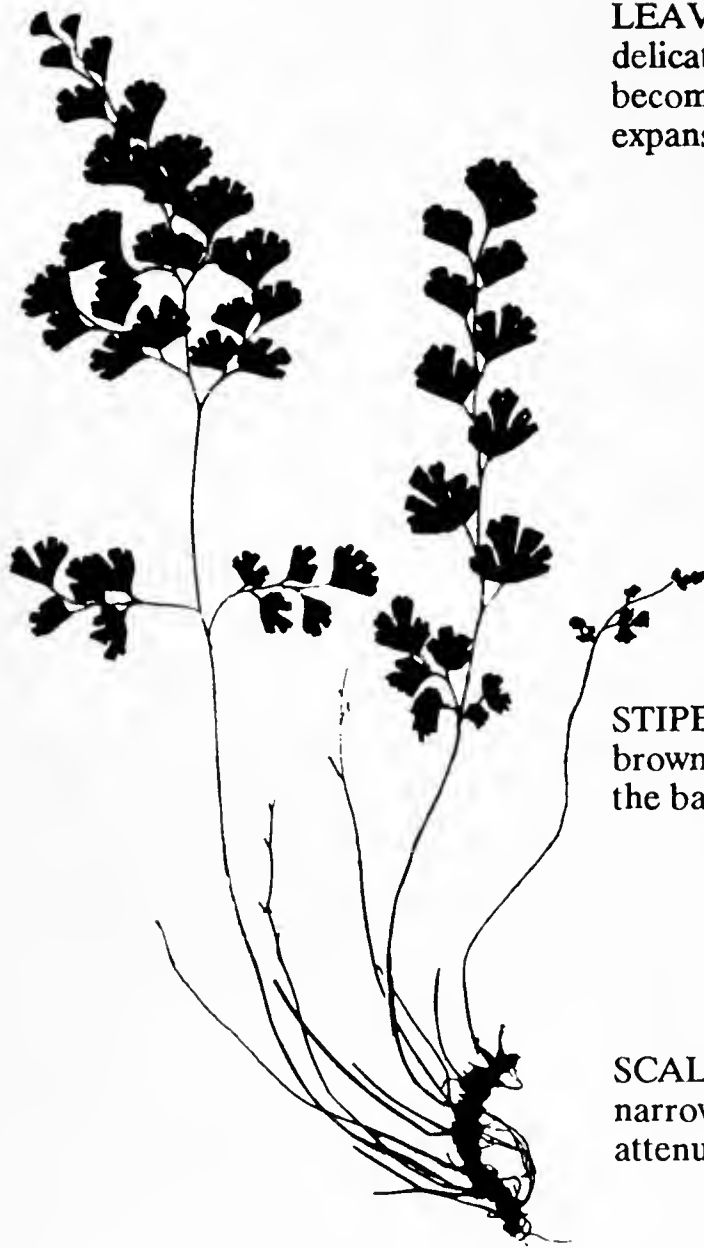
CONSERVATION STATUS: Vulnerable because of limited sites and because lane banks are frequently cleared.

COMPARE WITH:

There is no fern in Britain with which this species can be confused, but it could be overlooked as a seedling of Umbelliferae or a crucifer because of its leaf shape and herbaceous texture.

27 Maidenhair Fern

Adiantum capillus-veneris L.



LEAVES up to 30+ cm, delicate, red in crozier stage, becoming bright green with expansion, 1- to 3-pinnate.

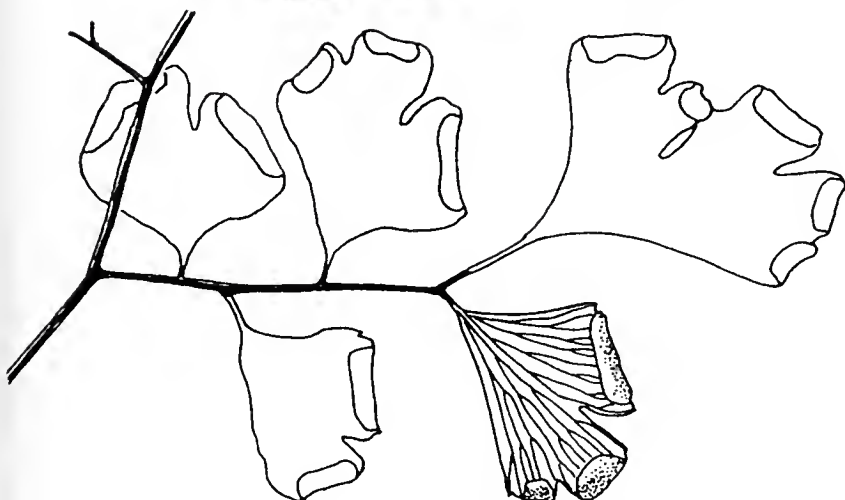
STIPE shiny black or dark brown, with a few scales at the base.

SCALES brown, clathrate, narrowly triangular, very attenuate.

HABIT: Erect or pendulous fronds produced in a tuft from a slender short-creeping rhizome; usually dying back in winter, but may over-winter in very sheltered sites.



ULTIMATE SEGMENTS wedge- or fan-shaped, without a midrib, sides straight and the outer margin of sterile ones notched, that of fertile ones folded under.



SORI on vein endings of the membranous, outer margins of pinnule segments which are folded under and act as a 'false indusium'.

HABITAT: Frost-free, wet, calcareous sites: on sheltered coastal cliffs, inland on mortared walls in warm sites such as walls of heated greenhouses.

DISTRIBUTION: Scattered sites in Ireland, Wales, SW and W England as far north as the Isle of Man and Cumbria. Usually established from the spores of cultivated plants at inland sites.

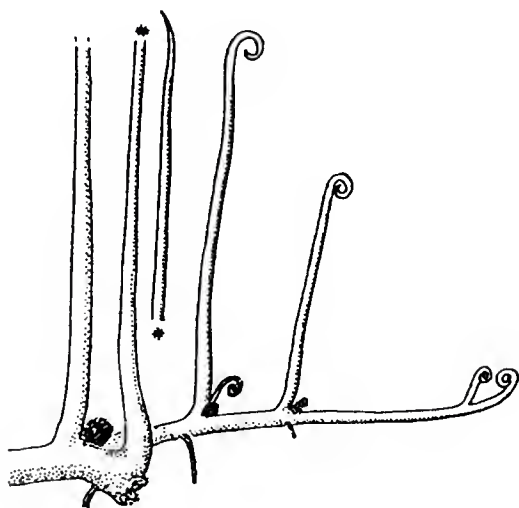
CONSERVATION STATUS: Coastal sites for this species are safe but inland limestone habitats are vulnerable to quarrying.

COMPARE WITH:

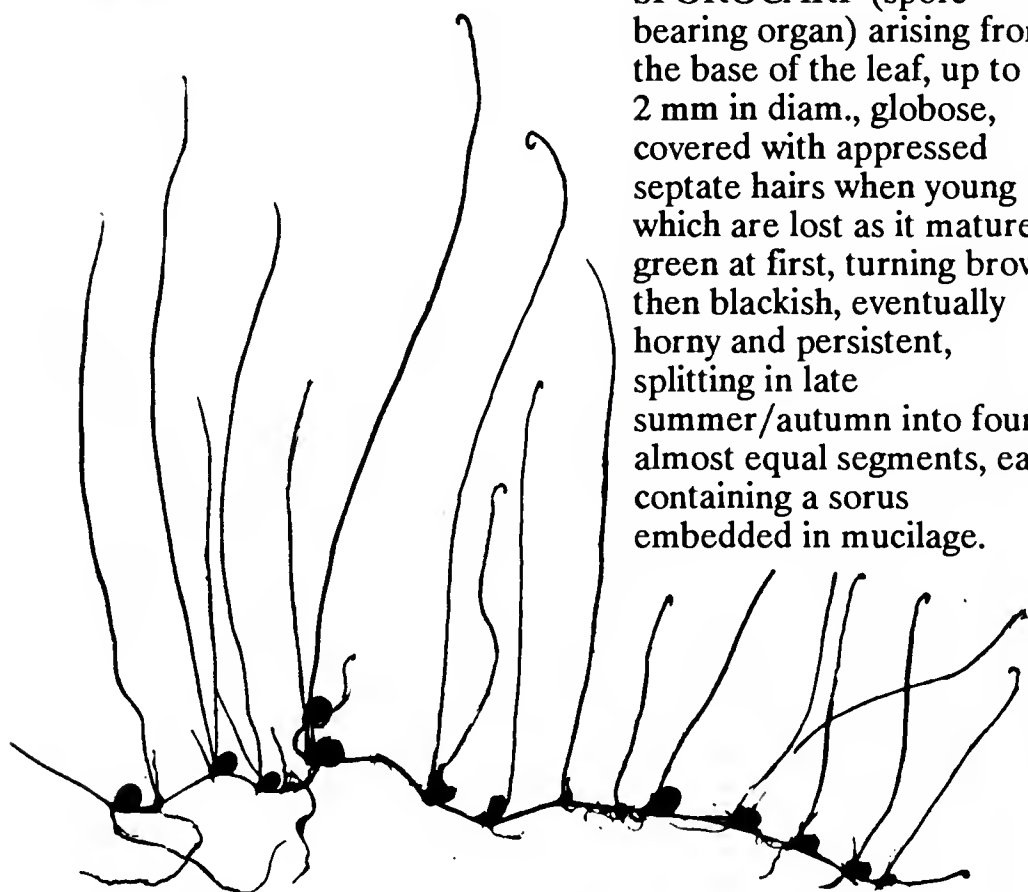
No other British fern has wedge- or fan-shaped ultimate leaf segments without an obvious midrib and with sori protected by the leaf margin.

28 Pillwort

Pilularia globulifera L.

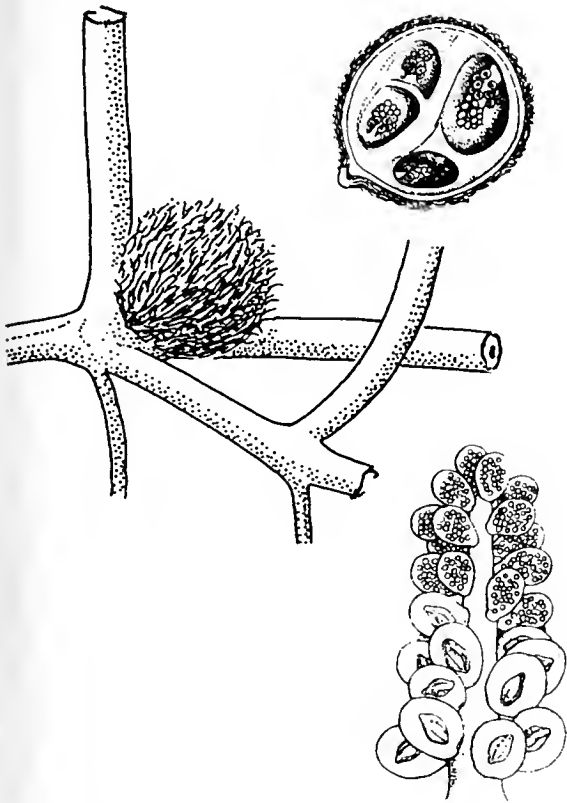


LEAVES c. 1 mm thick x 3-8 cm, or to 30 cm where plant totally and constantly submerged, comprising a filiform, terete leaf, erect or often arcuate or twisted, arising at intervals of 5-10 mm from the whitish, slender, branched, creeping rhizome, mid- or yellowish-green.



SPOROCARP (spore-bearing organ) arising from the base of the leaf, up to 2 mm in diam., globose, covered with appressed septate hairs when young which are lost as it matures, green at first, turning brown, then blackish, eventually horny and persistent, splitting in late summer/autumn into four almost equal segments, each containing a sorus embedded in mucilage.

HABIT: A plant which can develop a network of slender rhizomes forming an extensive and dense turf, or when in moss or with other herbs may be seen as isolated leaves arising from a far-creeping rhizome; wintergreen but cut back by extreme frosts.



SORUS contains two kinds of sporangia which dehisce their respective spores into the mass of mucilage surrounding them and in which germination and fertilisation takes place within a short time of dehiscence.

MICROSPORANGIA contain many microspores (x 400).

MEGASPORANGIA contain a single ovoid, slatey grey megaspore (x 10, but visible to the naked eye).

HABITAT: A lake-margin plant which can withstand submersion for extended periods; thrives in habitats with little other competition, characteristic of disused brick-clay pits, dew and other man-made ponds, especially where poached by animals; at the edges of reservoirs, occasionally in peaty pools and in heathland hollows on sand if water contains some nutrients; from 0 - 400 m (1200 ft).

DISTRIBUTION: scattered throughout the British Isles but scarce in the peaty moorlands of Scotland; in Ireland in the west and north.

CONSERVATION STATUS: An endangered species found only in western Europe; Britain is one of the remaining strongholds, and here, 60% of the sites have been lost due to habitat change.

Protected in Ireland under the *Flora (Protection) Order, 1980* and the *Wildlife (NI) Order, 1985*.

COMPARE WITH:

There is no other species with which it can be confused, although because of its rhizomatous rush-like nature it could be mistaken for a species of *Juncus*. The young leaves of *Pilularia*, however, show the coiled crozier typical of a fern.

29-31 The Filmy Ferns

Hymenophyllaceae

Introduction

Growing in small or large colonies or intermingled with mosses and liverworts on steep streamsides, ravines, rocks or tree boles in sites where the humidity is constantly extremely high.

Characteristics of Hymenophyllaceae

Small to medium-sized, evergreen plants with translucent, membranous, 2-3-pinnate leaves produced at intervals on a wire-like, creeping rhizome. Sori in pockets at the leaf margin.

Field key to species

- 1 Leaves dark green, 2-3-pinnate; pinna base decurrent on petiole; sorus a flask-shaped, lipless pocket at leaf edge, with receptacle protruding as a bristle as sorus matures
Trichomanes speciosum (31)
- 1 Leaves olive- or blue-green, 2-3-pinnatifid; pinna base not decurrent on petiole; sorus an ovoid or orbicular lipped pocket at leaf edge, with receptacle always concealed within it 2
- 2 Leaves olive-green, linear in outline, arching away from substrate; lips of sorus not toothed
Hymenophyllum wilsonii (30)
- 2 Leaves blue-green, ovate-oblong in outline, hanging down laxly over substrate; lips of sorus toothed
Hymenophyllum tunbrigense (29)

Hybrids

There is evidence of hybridisation between *Hymenophyllum tunbrigense* and *H. wilsonii* in Madeira, but hybrids have not been recorded in the British Isles.

Gametophytes of Hymenophyllaceae

The ecology and distribution of the gametophyte (or prothallus) stage of ferns is not discussed in this book because of the problems of identification. Gametophytes are usually found close to the sporing plant which, from a distribution record point of view, are easier to identify. Thus the ecological requirements of the gametophyte appear to be very much the same as the larger sporophyte, always assuming that there is sufficient moisture to maintain growth and permit fertilisation. A gametophyte normally dies when the sporophyte arising from it has become well established as an independent plant, although the gametophyte of the Jersey fern (*Anogramma leptophylla*) is known in some instances to have survived from year to year when the associated sporophyte dies during a period of summer drought.

The Hymenophyllaceae exhibit a phenomenon seen in only a few families of ferns: the gametophyte has been able to establish itself and maintain viable populations in areas unsuitable for the sporophyte, thereby extending the geographic range of the species. The gametophyte of *Trichomanes speciosum*, which is filamentous, has been recorded in Britain over a much wider range than the spore-bearing plant but appears to lack sex-organs and the ability to produce plants of the next generation. It does, however, produce gemmae as small, single-celled bodies which break off from the filaments of the gametophyte and thereby propagate the plant. It may be seen as mats, often extensive, of green alga-like filaments, usually in very dark recesses in caves and below overhangs.

29 Tunbridge Filmy Fern

Hymenophyllum tunbrigense (L.) Sm.



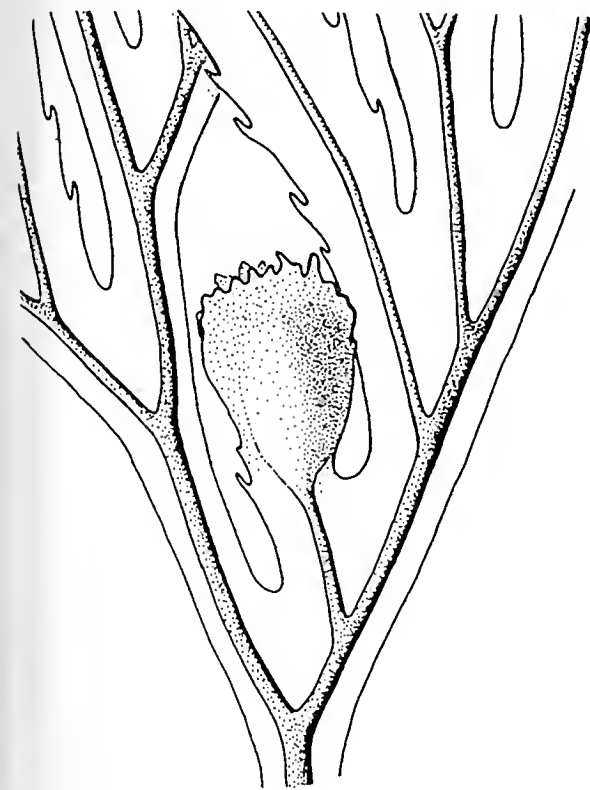
LEAVES 2-5 (-11 or more) cm long.

LEAF-BLADE ovate-oblong, 1-pinnate, translucent, blue-green.

STIPE $\frac{1}{3}$ - $\frac{1}{2}$ leaf length, wiry, \pm glabrous, winged only near the top.



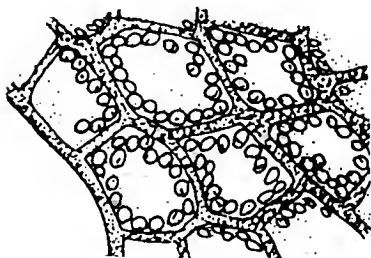
HABIT: Leaves **hanging laxly down over substrate**, borne at intervals on a thin, wiry, long-creeping rhizome; wintergreen.



PINNAE \pm evenly divided, with 5-11 segments on large pinnae; margins and tips flat, serrated; bases decurrent as a wing on either side of rachis.

SORUS at edge of pinna segments, a small, orbicular, lipped pocket, held in plane of leaf; margins of lips ('indusium') irregularly toothed; sporangia concealed within pocket.

SPORES green.



CELLS between veins of pinna segments typically \pm square (c. $60 \times 39 \mu\text{m}$), with c. 30-40 chloroplasts per cell (x 100).

HABITAT: Often growing in luxuriant masses on steep rock faces and tree boles at low altitudes (up to c. 400m, 1300 ft) where the humidity is constantly very high.

DISTRIBUTION: Widespread in W Britain and in Ireland with outliers in the Weald, W Yorkshire and Northumberland.

CONSERVATION STATUS: Vulnerable to woodland clearance that exposes sites to drying winds; not threatened in its main areas.

COMPARE WITH:

(30) *H. wilsonii*, which holds the sori out from the plane of the leaf and has entire margins to the lips of the sori.

30 Wilson's Filmy Fern

Hymenophyllum wilsonii Hooker

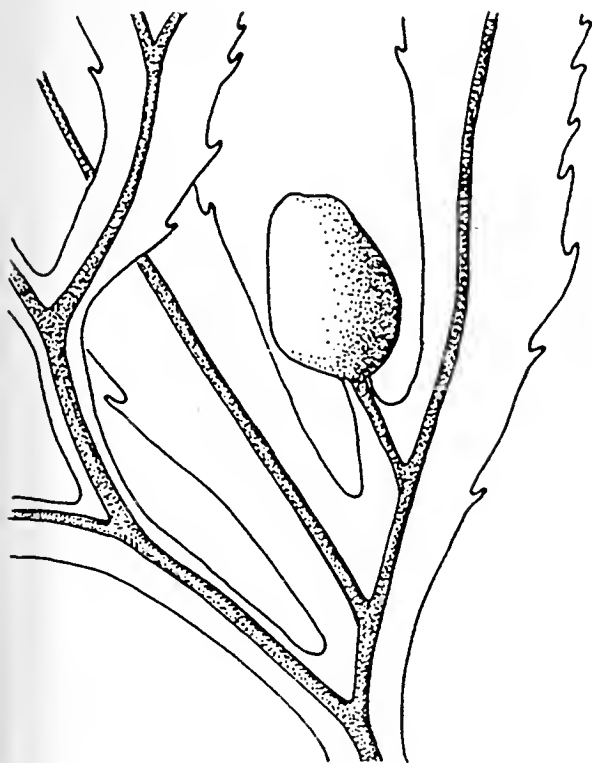
LEAVES 3-10 (or more) cm long.

LEAF-BLADE linear, 1-pinnate, translucent, olive-green.

STIPE not usually more than 1/3 leaf length, wiry, \pm glabrous, winged only near the top.



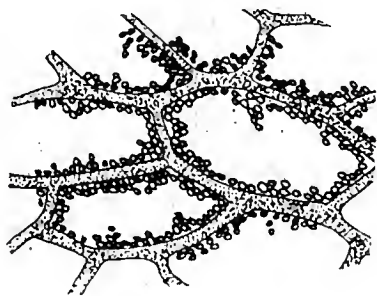
HABIT: Leaves arching away from substrate, borne at intervals on a thin, wiry, long-creeping rhizome; wintergreen.



PINNAE \pm unilaterally divided (upper side), with 3-5 segments on large pinnae; margins and tips recurved, serrated; bases decurrent as a wing on either side of rachis.

SORUS at edge of pinna segments, a small, ovoid, lipped pocket, held out from plane of leaf; margins of lips ('indusium') entire; sporangia concealed within pocket.

SPORES green.



CELLS between veins of pinna segments typically \pm rectangular (c. $94 \times 39 \mu\text{m}$), with c. 60-80 chloroplasts per cell (x 100).

HABITAT: Often growing in scattered patches on steep stream banks, rock faces and tree boles or amongst mountain scree (up to c. 1000 m, 3300 ft) where the humidity is constantly very high.

DISTRIBUTION: Widespread in W Wales, the English Lake District and Scotland, with local sites in SW England; throughout Ireland but mostly in the SW.

CONSERVATION STATUS: Not threatened, but rare outside the British Isles.

COMPARE WITH:

(29) *H. tunbrigense*, which holds sori in the plane of the leaf and has toothed margins to the lips of the sori.

31 Killarney Bristle Fern

Trichomanes speciosum Willd.

LEAVES up to 45 cm long.

LEAF-BLADE broadly ovate to ovate-lanceolate, 2-3-pinnate, **translucent, dark green.**

PINNAE triangular-ovate, finely divided, margins entire, bases decurrent as a wing on either side of the rachis and stipe.

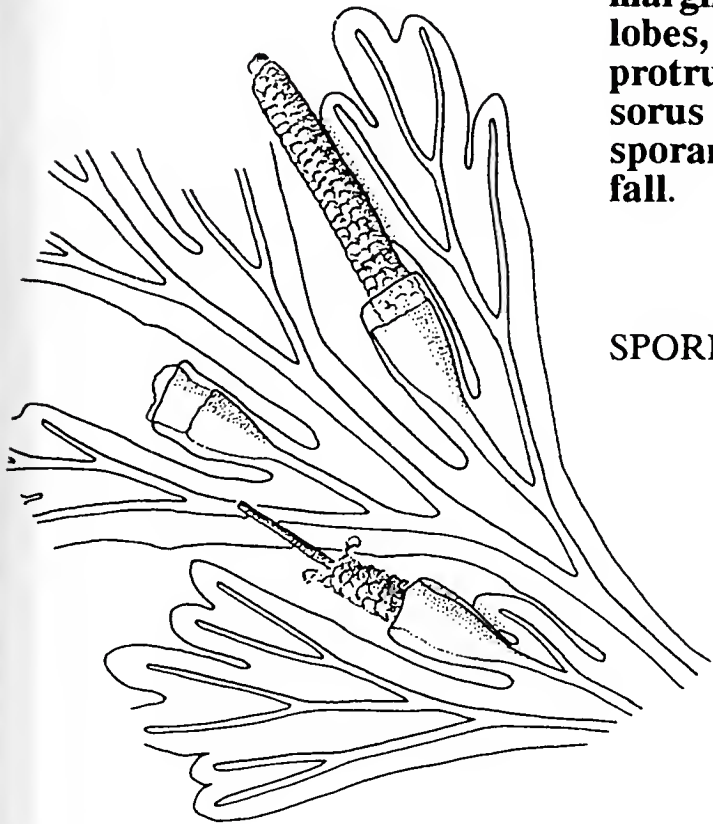


STIPE about 1/2 leaf length, dark translucent green, \pm glabrous, narrowly winged almost to base.

HABIT: Leaves arching down over substrate, borne at intervals on a slender, long-creeping and branching rhizome that bears dark, hair-like scales; wintergreen.

SORUS on the acroscopic edge of pinna segments, a small flask-shaped pocket with entire margin and without free lobes, receptacle protruding as a bristle as sorus matures and sporangia dehisce and fall.

SPORES green.



HABITAT: On rocks and in crevices in very sheltered sites through which water is constantly running.

DISTRIBUTION: Very few localities in W Britain from Cornwall to W Scotland; mainly in the west of Ireland.

CONSERVATION STATUS: Protected in Britain under the *Wildlife and Countryside Act, 1981*; and in Ireland under the *Flora Protection Order, 1980* and the *Wildlife (NI) Order, 1985*.

COMPARE WITH:

(29, 30) **Hymenophyllum** species, which have smaller, less divided leaves, sori with 'indusial' lips and thread-like rhizomes.

32-34 The Polypodies

Polypodiaceae: *Polypodium*

Introduction

Often forming large colonies on steep banks, boulders, cliff faces, old walls or epiphytic on mature broad-leaved trees growing in areas of constantly high humidity.

Treated as one species in Britain in earlier floras, and now realised to be a complex of two species (*Polypodium cambricum* and *P. vulgare*), their fertile hybrid (*P. interjectum*), and the sterile hybrids and backcrosses with the parents. Often very difficult to separate and requiring observation of microscopic characters (the number of *indurated*, i.e. thick-walled, cells in the annulus and the number of unthickened basal cells between the annulus and sporangium stalk).

Characteristics of Polypodium

Stout, scaly, creeping rhizome with small to medium, firm to leathery, oval to triangular, pinnatisect, wintergreen leaves with a green, glabrous stipe $1/3 - 1/2$ leaf-length, each borne on a raised area (*podium*) of the rhizome. Sori round to oval, without indusia, regularly spaced on either side of the midrib of the leaf segment.

Field key to species

- 1 Leaves typically narrowly lanceolate to linear; annulus distinctly deep reddish-brown when sporangium is yellow, visible as a long, thin, red-brown line at x 10; rhizome scales narrowly triangular with acute, but not long or wispy, apex

vulgare (32)
- 1 Leaves narrowly ovate to deltoid; annulus indistinct or brown when sporangium is yellow, if visible then as a short, thickish, dark brown line at x 10; rhizome scales narrowly triangular with long or wispy apex

2
- 2 Leaves broadly ovate to deltoid; usually only a few sori, restricted to upper $1/3$ leaf; annulus visible when sporangium is yellow as a short, thickish, dark brown line at x 10; rhizome scales narrowly triangular with a long, wispy apex

cambricum (34)
- 2 Leaves narrowly ovate to oval; sori usually many, over upper $1/3 - 2/3$ leaf; annulus not obvious at x 10 when sporangium is yellow; rhizome scales narrowly triangular with long, but not wispy, apex

interjectum (33)

Hybrid Polypodies

The following hybrids (■) have been found in the British Isles:

P. x font-queri Rothm.

= (34) *P. cambricum* x (32) *P. vulgare*

P. x mantoniae Rothm.

= (33) *P. interjectum* x (32) *P. vulgare*

P. x shivasiae Rothm.

= (34) *P. cambricum* x (33) *P. interjectum*

		vul
	int	■
cam	■	■

The hybrids are intermediate between the parents and often show hybrid vigour by growing extremely large. Because of the difficulty in identifying the parents, it is essential that suspected hybrids are checked for abortive sporangia (which remain small and unopened) and spores (which are rarely shrivelled in this genus, but are colourless in contrast to the normal yellow spores).

P. x mantoniae is the commonest hybrid and often forms very large colonies on banks and tree boles.

P. x shivasiae is completely sterile; all the spores in a sporangium will be abortive.

32 Common Polypody

Polypodium vulgare L.

LEAVES 5-25 cm long, mid-green, **new leaves produced early summer.**

LEAF-BLADE narrowly lanceolate to linear (but juvenile or stunted leaves triangular), pinnatisect to an obvious herringbone pattern.

LEAF SEGMENTS
c. 2-4 cm long, entire or barely serrate, tips rounded, lowest pairs not inflexed.

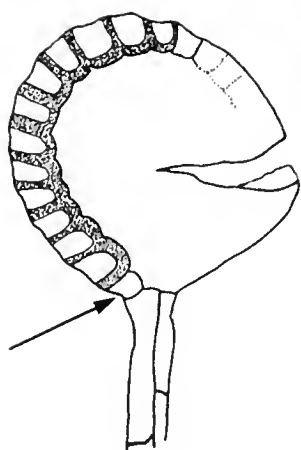
RHIZOME SCALES
narrowly triangular with acute, but not long and wispy, apex.

HABIT: Dense colonies of leaves produced at intervals from a stout, scaly, branched, creeping rhizome; wintergreen.





SORI round, on upper 1/4 - 3/4 leaf, **paraphyses lacking**.



SPORANGIUM with **annulus red-brown** (conspicuous at x 10), **indurated cells** (7-) 10-14 (-17), long and narrow (22 -28 μm x 60-80 μm) (x40), 1 basal cell (x 40) [arrowed] .

SPORES ripe in summer.

HABITAT: A weak calcifuge reaching fair altitudes, on peat banks, trees, drystone walls and tops of rocky outcrops and cliffs.

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(33) **P. interjectum**, which has more attenuate scales and 7-9 indurated annulus cells;

(34) **P. cambricum**, which has paraphyses in the sori and spores ripening in early spring.

33 Intermediate Polypody

Polypodium interjectum Shivas



LEAVES 15-60 cm long, mid-green, **new leaves produced late summer and autumn.**

LEAF-BLADE narrowly ovate to oval, pinnatisect.

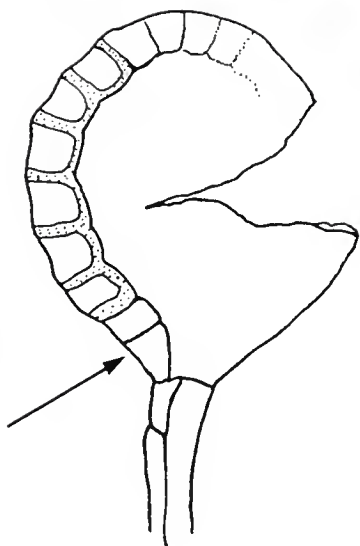
LEAF SEGMENTS c. 5 cm long, usually slightly serrate, tips tapering or bluntly rounded, lowest pairs somewhat inflexed.

RHIZOME SCALES narrowly triangular with long, but not wispy, apex.

HABIT: Dense colonies of leaves produced at intervals from a stout, scaly, branched, creeping rhizome; wintergreen.



SORI initially oval, on upper 1/3 - 2/3 of leaf, paraphyses lacking.



SPORANGIUM with pale annulus (not conspicuous at x 10), indurated cells (4-) 7-9 (-13), fairly long and not very narrow ($28-35\ \mu\text{m}$ x $76-86\ \mu\text{m}$) (x 40), 2-3 basal cells (x 40) [arrowed].

SPORES ripe
summer to autumn.

HABITAT: A weak calcicole on rocky banks and cliffs and mortared walls; on trees in maritime sites and on sand-dunes where salt-laden winds provide the necessary calcium and magnesium salts.

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(32) *P. vulgare*, which has more indurated cells in the annulus;

(34) *P. cambricum*, which has paraphyses in the sorus and spores ripening in early spring.

34 Southern Polypody

Polypodium cambricum L.



LEAVES 5-50 cm long, yellow-green, **new leaves produced autumn/winter.**

LEAF-BLADE broadly ovate-deltoid often with a long, narrow apical segment, pinnatisect.

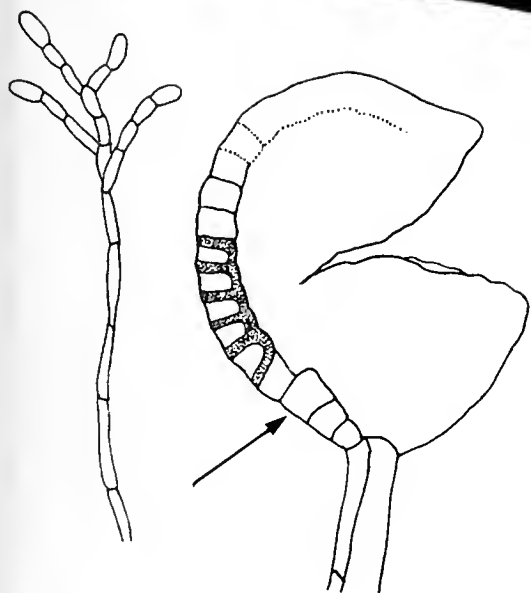
LEAF SEGMENTS up to 7 cm long, usually serrated and with acute apices, lowest pair inflexed.



RHIZOME SCALES narrowly triangular with a long wispy apex.

HABIT: Dense colonies of leaves produced at intervals from a stout, scaly, branched, creeping rhizome; turning yellow and dying down in late spring or early summer.

SORI oval, on upper 1/3 of leaf, **paraphyses** present.



SPORANGIUM with a dark brown annulus (conspicuous at x 10 at an early stage when the rest of the sporangium is yellow), indurated cells (4-) 5-10, short and broad ($21-26\ \mu\text{m}$ x $81-100\ \mu\text{m}$) (x 40), 3-4 basal cells (x 40).

[arrowed].

SPORES ripe in early spring.

HABITAT: Base-rich rocks usually on steep slopes or cliffs, walls and occasionally on trees in maritime sites.

DISTRIBUTION: Throughout lowland areas of S and W Britain, N to Argyll; scattered throughout Ireland.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(32) *P. vulgare*, which does not have paraphyses in the sori and has only one basal cell below the annulus;

(33) *P. interjectum*, which has narrower leaves and does not have paraphyses in the sorus.

35a Bracken

Pteridium aquilinum (L.) Kuhn
morphotype *aquilinum*

Genetically a very variable taxon; at least three subspecies have been described in Britain, but their relationships and taxonomy need clarifying. We describe here two forms (as 'morphotypes' because their rank is still in debate) that can be identified, but warn that there is considerable hybridisation within the species complex. A further morphotype, *atlanticum*, (C.N. Page, as subsp.) a frost-sensitive, soft-textured form with a succulent stipe and white hairy leaf is less distinct, and is included here within (35a) until further work clarifies its position.

LEAVES 1-2.5 m long, occasionally much longer in shady situations, erect; **young croziers densely covered with white hairs and very few rufous hairs.**

LEAF-BLADE oblong-lanceolate to ovate-triangular, 2- to 3-pinnate-pinnatifid, \pm erect, texture tough, often leathery in exposed situations, \pm **matt, almost grey-green.**



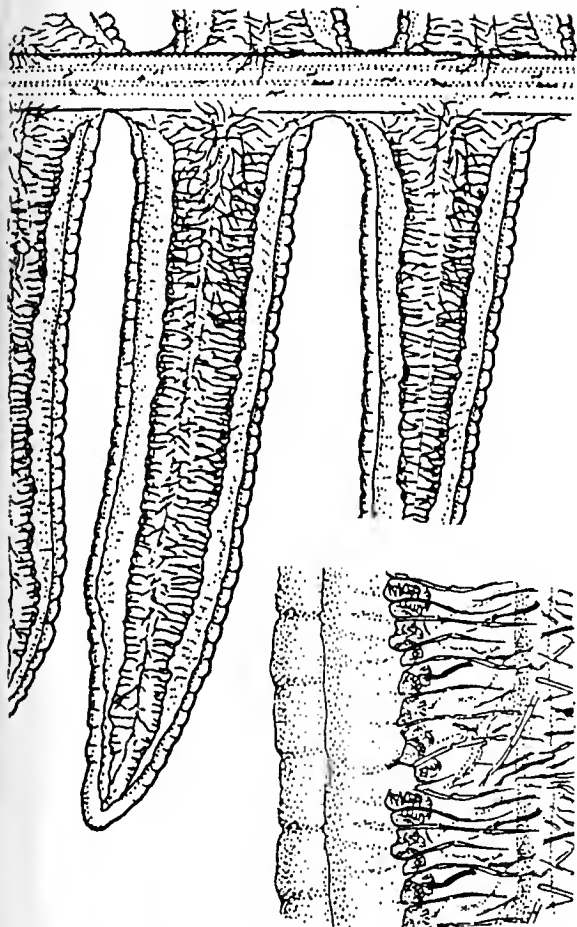
PINNAE up to 70 cm long, **perpendicularly inserted and horizontally inclined, developing sequentially towards the apex of the leaf**, ovate-lanceolate, pinnate-pinnatisect, apex attenuate, drooping.

RACHIS \pm glabrous, pale green, bearing nectaries at pinna junctions.

STIPE dark at base pale red-brown to green above, **succulent and mucilaginous until leaf fully expanded.**

SCALES lacking, rhizome tip and emerging leaves bearing hairs only.

HABIT: Leaves arising intermittently from a deep underground branched rhizome forming large and characteristic stands; dying in winter, forming a pale brown litter as the stipes collapse.



PINNULES linear-lanceolate, apex acute or attenuate to caudate.

ULTIMATE SEGMENTS to 15 mm long, linear, adnate at the base, apex acute or obtuse, margins inrolled; **often densely covered below with many colourless (appearing white) and scattered rufous hairs, best seen on unfurling croziers.**

SORUS marginal and continuous round the entire pinnule, covered by a membranous 'false indusium' formed from the leaf margin and which is present even if the leaf segment is sterile.

INDUSIUM membranous, fringed, continuous round pinnule.

HABITAT: A ubiquitous and aggressive species which colonises open areas e.g. heaths, rough and hill grassland, old pasture, roadsides, woodland rides, etc.; prefers deep (>25 cm) sandy or well-worked loamy soils, even on calcareous substrates if soil deep enough, but usually absent from heavy clays.

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: In no way threatened but itself often a threat to rare heathland species.

COMPARE WITH:

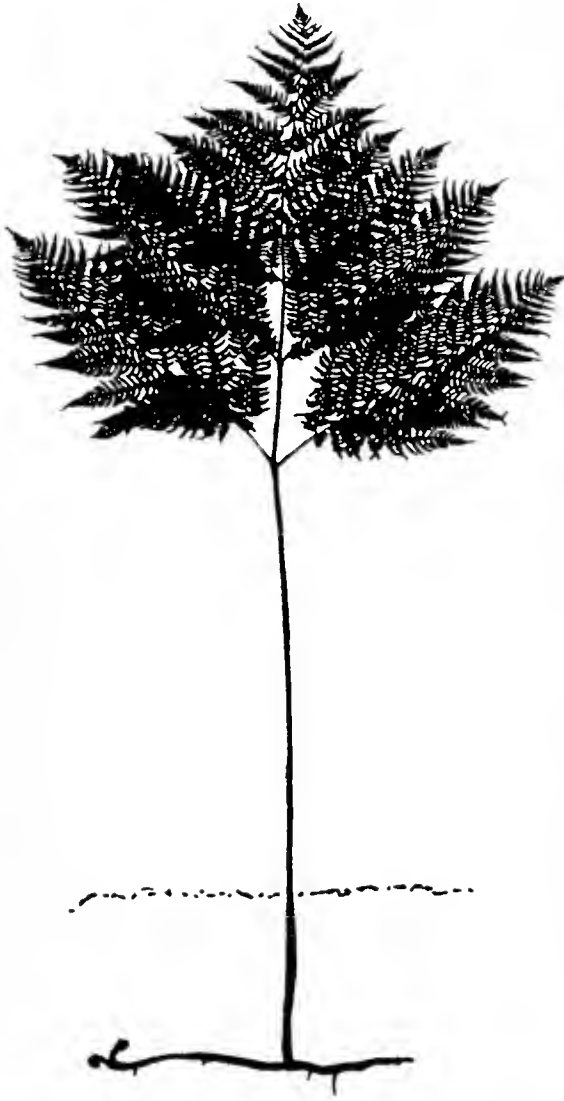
(35b) *P. aquilinum* morphotype **latiusculum** which can be recognised by the conspicuous red-brown hairs on unfurling leaves, the deflexed, \pm deltate leaf-blade with acutely inserted pinnae and the thin stipe.

Very young plants often get established on walls and old building sites and resemble *Dryopteris* species, but presence of fine hairs instead of scales on the rhizome apex confirms it as Bracken.

35b Northern Bracken

Pteridium aquilinum (L.) Kuhn

morphotype *latiusculum* (sensu C.N. Page)



LEAVES 0.8-1.2 m long, occasionally longer, erect; young croziers covered with dense pale rufous hairs and some scattered colourless hairs.

LEAF-BLADE 2- to 3-pinnate-pinnatifid, broadly deltate, sub-ternate, deflexed to a low angle from its junction with the stipe, texture herbaceous, \pm matt, grass-green.

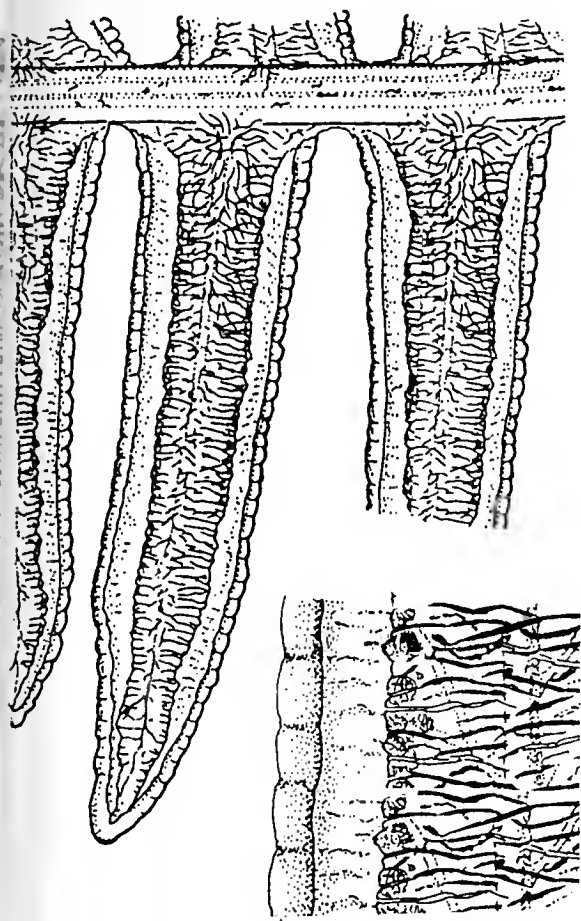
PINNAE up to 50 cm long, obliquely inserted, not rotated from the plane of the rachis, developing almost simultaneously throughout the leaf, ovate-triangular, apex attenuate, not drooping.

RACHIS \pm glabrous, pale green or stramineous, bearing nectaries at pinna junctions.

STIPE dark at base, pale red-brown to green above, **tough and wiry, weakly mucilaginous.**

SCALES lacking, rhizome tip and emerging leaves bearing hairs only.

HABIT: Leaves arising intermittently from a deep underground branched rhizome forming large and characteristic stands; **leaves turning deep red-brown through winter.**



PINNULES linear-lanceolate, apex acute or attenuate to caudate.

ULTIMATE SEGMENTS similar in size and shape to (35a) but covered below with many rufous and a few colourless hairs, best seen on unfurling croziers.

SORUS marginal and continuous round the entire pinnule, covered by a membranous 'false indusium' formed from the leaf margin and which is present even if the leaf segment is sterile.

INDUSIUM membranous, fringed, continuous round pinnule.

HABITAT: Associated with forests of native Pine (*Pinus sylvestris*) and Juniper (*Juniperus communis*) and adjacent roadside verges on deep acidic soils.

DISTRIBUTION: Recorded from Strath Spey and a few other W Scotland ancient pine forests.

CONSERVATION STATUS: Not threatened as long as forest protected.

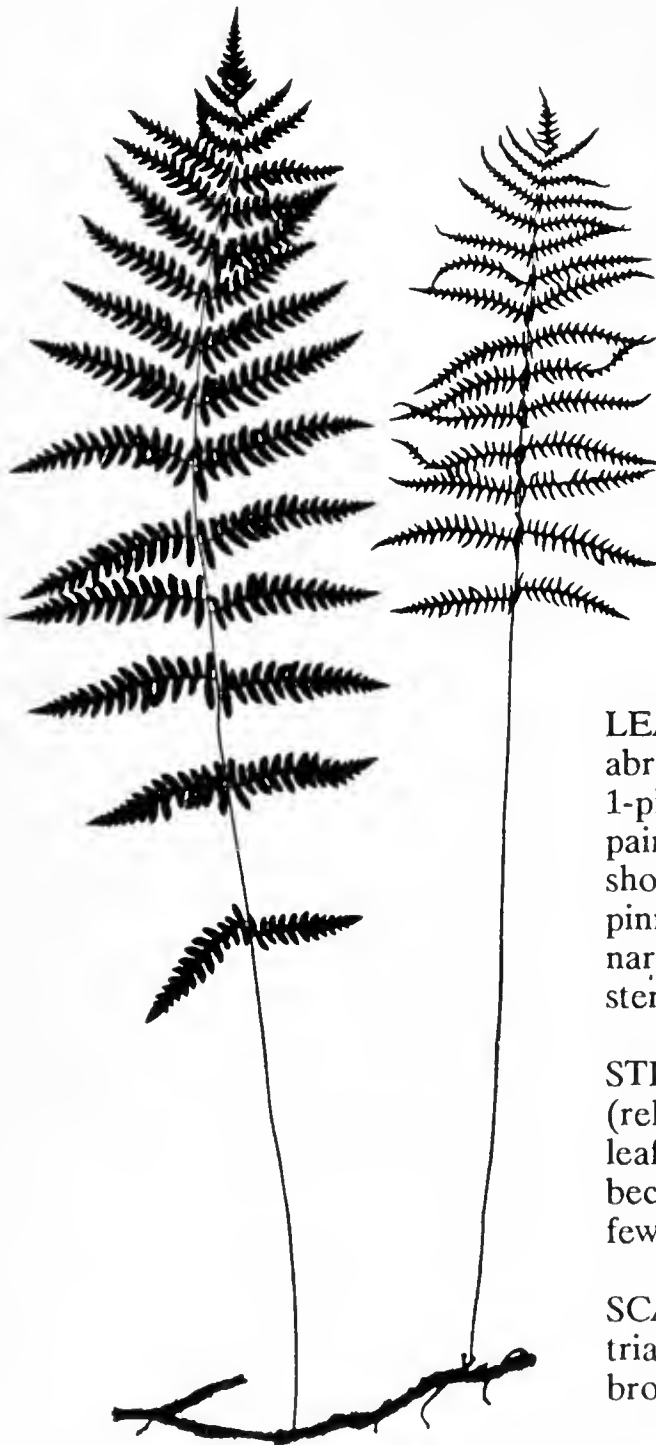
COMPARE WITH:

(35a) **P. aquilinum** morphotype **aquilinum** which has more white than red-brown hairs on unfurling leaves, a taller, more linear-lanceolate, erect leaf-blade, horizontally orientated pinnae inserted at right-angles, and a thicker, more succulent stipe.

Enzyme analysis has shown that this form is not identical to the plant described under this name from N America, but it may be the same as the northern European variety called *latiusculum*.

36 Marsh Fern

Thelypteris palustris Schott



STERILE LEAVES
appearing first in
spring, up to
c. 80 cm.

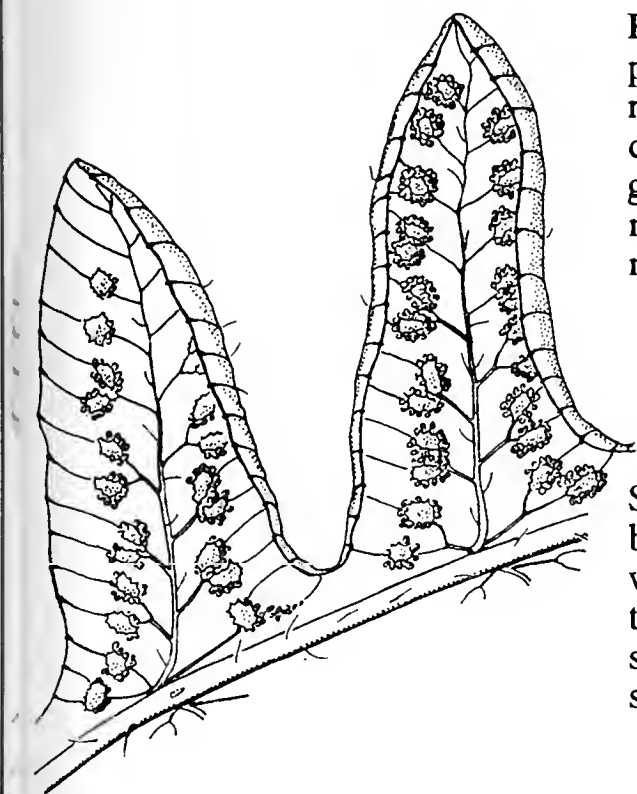
FERTILE LEAVES
appearing in early
summer, up to
c. 150 cm.

LEAF-BLADE lanceolate,
abruptly tapered at apex,
1-pinnate-pinnatisect, lowest
pairs of pinnae only slightly
shorter than middle pinnae,
pinnae of fertile leaf
narrower than those of
sterile leaf, pale green.

STIPE up to 1/2 leaf length
(relatively longer in fertile
leaf), slender, green,
becoming black and with a
few scales at the base.

SCALES few, broadly
triangular, apex acute,
brown, soon lost.

HABIT: Leaves few, at intervals (sometimes several centimetres apart) on a long-creeping, branched, thin rhizome; dying down in late autumn.



PINNAE held flat in leaf plane, margins of segments rolled under, partly concealing sori, no obvious glands on either surface, minute hairs scattered on mid-rib and veins.

SORI round, mid-way between pinna segment mid-vein and margin, appearing to cover whole of pinna segment's lower surface as sori mature.

INDUSIUM small, delicate, round-oblong to kidney-shaped, margin irregular and glandular; soon lost.

HABITAT: Mires, fens and reedswamps, particularly in *Phragmites* and *Cladium* communities.

DISTRIBUTION: Throughout the British Isles, becoming very rare in Scotland.

CONSERVATION STATUS: Threatened by land drainage; at least 40% of sites lost in England and Wales since 1950.

COMPARE WITH:

The long, slender stipe and delicate leaf arising from a thin, wide-creeping rhizome make this species distinctive.

37 Beech Fern

Phegopteris connectilis (Michx) Watt



LEAVES (15-) 20-40 cm long.

LEAF-BLADE triangular to broadly ovate, tapered to an acute apex, 1-pinnate-pinnatisect, lowest pair of pinnae deflexed forward out of plane of blade, whole blade often reflexed to lay almost horizontal, finely hairy on both surfaces, light green (as in young beech leaves).

PINNAE lanceolate, lowest pair attached by midrib only, upper ones adnate.

STIPE $\frac{1}{2}$ - $\frac{2}{3}$ leaf length, minutely hairy, very few scales at base.

SCALES ovate, colourless, soon lost.

HABIT: Leaves few, at intervals from a slender, branched, creeping, underground rhizome; dying down in late autumn.

PINNA-SEGMENTS
oblong, apex rounded.



SORI round, very close to
margin and mainly around
sinus, without indusium.

HABITAT: Not in beech woods! In colonies on moist, shady banks in woodland and streamsides where water percolates or on moist patches on rocky slopes and cliff ledges in mountains up to c. 600 m (2000 ft).

DISTRIBUTION: Locally frequent in upland Wales, N England and Scotland, rare and scattered in S England and Ireland.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

The shape and the hairiness of this species is distinct and it cannot be confused with any other.

38 Lemon-scented Fern

Oreopteris limbosperma (Bellardi ex All.) J. Holub



LEAVES 30-120 cm long.

LEAF-BLADE

oblanceolate-elliptic tapered to acute apex, 1-pinnate-pinnatisect.

PINNAE linear-lanceolate, gradually tapered to apex, **lowest pinnae gradually decreasing in size**, yellow-green.

RACHIS and PINNA MIDRIBS with a few scales and many fine glandular and non-glandular hairs; pale yellow-green.

STIPE up to 1/5 leaf length, with sparse covering of scales.

SCALES colourless, appearing white or pale brown.

HABIT: Leaves forming a 'shuttlecock' on a short, branched rhizome; dying down early in winter.



PINNA SEGMENTS

linear-oblong, shallowly lobed, with **minute glands covering lower surface and giving a lemon scent when brushed.**

SORI very close to pinnule segment margin.

INDUSIUM rudimentary or completely absent; when present small, irregular in shape with a glandular margin.

HABITAT: Damp, peaty sites on mountain sides, steep stream banks and gullies, and open acidic woodland.

DISTRIBUTION: Throughout the British Isles, but commoner in upland districts of N Wales and W Scotland and scarce in S England.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(61, 62, 63) **Dryopteris** species may be confused in their younger stages but they lack glands and markedly decrescent pinnae;

(A6) **Matteuccia struthiopteris** which has a narrower, more elliptic leaf completely lacking glands.

39-48 The Spleenworts and their relatives

Aspleniaceae: *Asplenium*

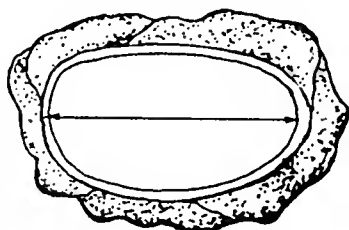
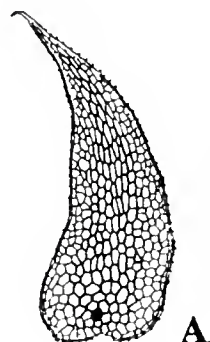
Introduction

The Spleenwort genus *Asplenium* includes here the Hart's Tongue, sometimes put into a separate genus *Phyllitis*, and the Rustyback, sometimes segregated as the genus *Ceterach*. Although superficially distinct, we find their characteristics within the range of *Asplenium* when viewed on the wider European basis and prefer to treat them in that genus, as is usually the case in Continental Floras.

Characteristics of Asplenium

Predominantly tufted plants of rocky substrates and walls, usually with many crowns and a short-creeping rhizome, covered at its apex with *clathrate* scales (i.e. scales composed of cells which are pigmented only on their radial walls and therefore appear as a lattice window) [Fig. A]; leaves, with few exceptions, of a hard, tough texture, shiny on the upper surface; sori linear-oblong on lateral veins of leaf segment, covered by a linear indusium which is pushed back by the developing sporangia, often becoming confluent and appearing to cover the whole leaf; spores with irregular crests.

An interrelated reticulate complex of diploid and tetraploid species in which the tetraploid taxa are frequently difficult to



separate from their diploid progenitors. In these cases spore size is important and the length of the inner wall or *exospore* (as shown in the adjacent figure [B]) should be measured in water (at least a mean of 30 spores) to compare with those given here.

Field key to species

- | | | |
|---|--|--------------------|
| 1 | Leaves undivided, entire | scolopendrium (39) |
| 1 | Leaves forked, trifoliate, pinnate or more dissected | 2 |
| 2 | Leaves forked, trifoliate or 1-pinnate | 3 |
| 2 | Leaves 2- or 3-pinnate or 2-pinnate-pinnatisect | 7 |

- | | | | |
|---|--|--|---|
| 3 | Leaves forked or with 2 or 3 clustered pinnae | septentrionale (47) | |
| 3 | Leaves pinnatisect or pinnate with at least 8 ± equal pairs of pinnae | | 4 |
| 4 | Leaf segments adnate to rachis, densely scaly beneath | ceterach (48) | |
| 4 | Pinnae petiolate, orbicular to oblong, glabrous or not obviously scaly beneath | | 5 |
| 5 | Pinnae rhomboid-oblong, over 15 mm long | marinum (43) | |
| 5 | Pinnae round-oblong, up to 11 mm long | | 6 |
| 6 | Rachis green throughout length of leaf | trichomanes-ramosum (45) | |
| 6 | Rachis black- or red-brown (except at leaf apex) | trichomanes (44) | |
| 7 | Pinnae irregularly cut into ± equal segments | ruta-muraria (46) | |
| 7 | Pinnae regularly pinnate, segments decreasing to pinnatisect apex | | 8 |
| 8 | Leaf-blade and pinnae triangular to triangular-ovate | | 9 |
| 8 | Leaf-blade and pinnae linear-lanceolate to lanceolate | obovatum subsp. lanceolatum (42) | |
| 9 | Apex of leaves, pinnae and ultimate segments caudate | onopteris (41) | |
| 9 | Apex of leaves, pinnae and ultimate segments blunt or rounded | adiantum-nigrum (40) | |

Hybrids

For a list of, and notes on, hybrid spleenworts, see p. 118.

39 Hart's Tongue

Asplenium scolopendrium L.



LEAVES up to 75 cm (or rarely to 1 m), **undivided**.

LEAF-BLADE
lanceolate or linear-lanceolate, (young plants ovate, broadly lanceolate or hastate) base cordate, lobed or auriculate, apex acute or occasionally obtuse; margin wavy, irregularly crenate or occasionally irregularly cut (especially when growing on damp walls).

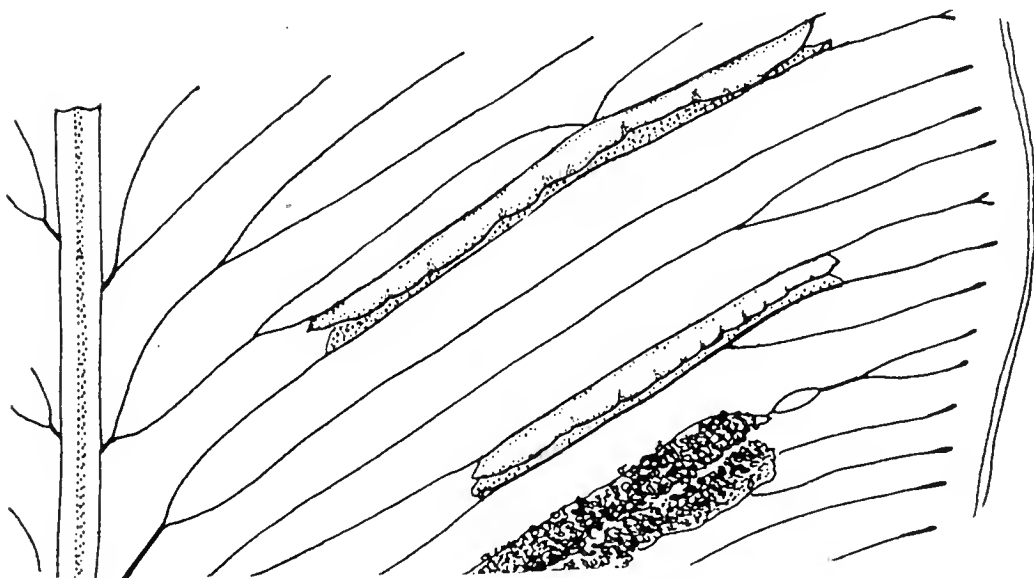
STIPE $\frac{1}{6}$ - $\frac{1}{3}$ of leaf length, of a dark purple-black colour which persists well up the rachis, scaly below.

SCALES c. 8 mm long, linear-triangular, pale brown.

HABIT: Rhizome, short, stocky and erect, branching to form many close crowns; leaves forming an irregular cluster; wintergreen; young croziers very pale, almost translucent green.

SORI linear, lying in close pairs along \pm parallel, adjacent veins, \pm median position between rachis and margin, throughout the whole length of the leaf.

INDUSIA linear, membranous, those of a pair opening towards each other.



HABITAT: A plant of base-rich habitats, on limestone, basalt, andesite and other base-rich substrates, or where salt-laden winds replenish soils with magnesium, and in such situations found amongst shady scrub in sand-dune slacks and on Cornish lane banks on granite; in damp gullies and gorges in mountainous districts but rarely above 200 m (666 ft); a dominant fern in ash woods on limestone.

DISTRIBUTION: Common throughout England and Wales, and in Ireland; in Scotland its distribution is governed by altitude and lack of suitable substrates.

CONSERVATION STATUS: Not threatened in any way.

COMPARE WITH:

This fern can be confused with no other.

A. scolopendrium is a species with a range of variation of shape and margin characteristics which has given rise to many cultivars, many of which were (and might still be) found in the wild; most are sterile and can only be propagated vegetatively.

40 Black Spleenwort

Asplenium adiantum-nigrum L.



LEAVES 10-25 cm long in more exposed sites, up to 50 cm when in sheltered woodland.

LEAF-BLADE triangular or triangular-ovate, 2-3-pinnate or 2-pinnate-pinnatisect, shiny, deep mid-green.

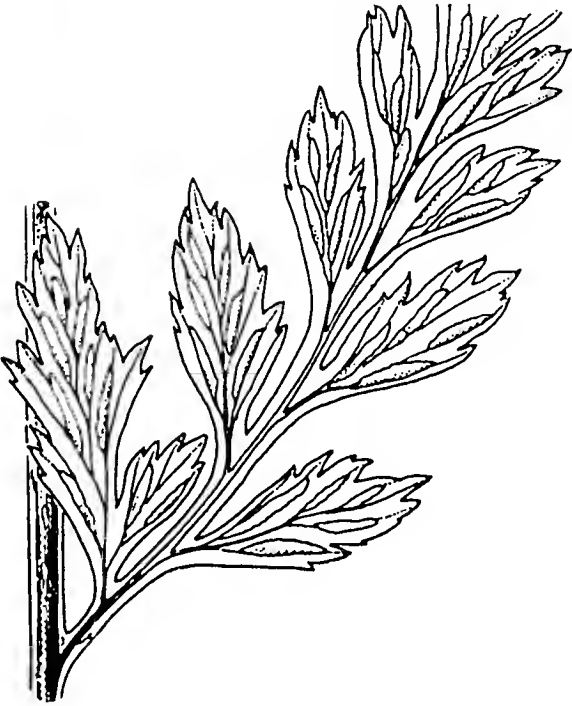
PINNAE up to 15 pairs, the lowest pair the longest, up to 10 cm long, decreasing in size to the pinnatisect leaf apex; \pm triangular-ovate to broadly trowel-shaped.

NOTE: The shape of both pinnae and ultimate segments very variable, as shown in the sample of leaf silhouettes, and some forms are very difficult to distinguish from (41) and the Continental *A. cuneifolium* (see below).

STIPE black to red-brown, shiny, glabrous.

SCALES on rhizome growing point narrowly triangular-lanceolate with darker, more opaque cells in centre.

HABIT: A very variable plant with leaves in a loose tuft from a short-creeping rhizome; wintergreen.



ULTIMATE SEGMENTS ovate-elliptic to oblanceolate, often deeply and sharply toothed.

SORUS 1-3 mm, linear-oblong, on lateral veins and appearing closer to the midrib than to the segment margin.

INDUSIUM linear-oblong, entire.

EXOSPORE length 30-37 μm (x 400).

HABITAT: Requires a trace of base-rich elements and rarely found on acid rock; a plant of rocky places, cliffs, screes, hedgebanks (particularly in SW England), and climax woodland established over calcareous rock scree; generally an uncommon component of mortared wall floras, and in areas of low rainfall only on walls exposed to prevailing winds; rarely above 600 m (2000 ft).

DISTRIBUTION: Throughout the British Isles; commoner in coastal areas of the west, absent from some areas in Central and Highland Scotland and the colder rain-shadow east of the Pennines.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

- (41) *A. onopteris*, which has more caudate tips to the pinnae and leaf apex, and smaller spores;
- (42) *A. obovatum* subsp. *lanceolatum* which has a lanceolate leaf-blade, narrower, more oblong pinnae, and sori nearer the margin.

Asplenium cuneifolium Viv., a diploid species with flabellate ultimate segments with obtuse teeth, known from ultrabasic rock in mainland Europe, has been recorded from the British Isles in error: all such plants have been confirmed as tetraploids and must be regarded as a form of *A. adiantum-nigrum*. The diploid may, however, occur on serpentine rocks in our area.

41 Acute-leaved Spleenwort

Asplenium onopteris L.



LEAVES 15-25 cm long, sometimes longer when in sheltered sites.

LEAF-BLADE triangular, 3-pinnate or 3-pinnate-pinnatisect, tapering to a caudate apex, very shiny above, mid-green.

PINNAE triangular or triangular-ovate, up to 12 cm long, **the lowest pinnae the longest**, decreasing in size to a pinnatisect caudate apex.

NOTE: As with (40) there is considerable variation in the shape of pinnae and ultimate segments in Continental material, sometimes appearing very similar to (40), although Irish material is \pm constant and more like the Iberian plants.

STIPE black to red-brown, shiny, glabrous; coloration extending well into rachis.

SCALES narrowly triangular-lanceolate with darker, more opaque cells in centre.

HABIT: A plant with a short-creeping rhizome with evergreen leaves in a loose tuft.



ULTIMATE SEGMENTS narrowly lanceolate with an acute apex.

SORUS 1-2 mm long, oblong, on lateral veins and closer to the midrib than the segment margin.

INDUSIUM linear-oblong, entire.

EXOSPORE length 25-30 μm , (x 400).

HABITAT: Predominantly a lowland, terrestrial plant on banks under light shade or on old scree colonised by scrub; requiring a modicum of base-rich elements; occasionally found on rock in maritime situations.

DISTRIBUTION: A Mediterranean species known only in the British Isles from SW Ireland. Records for the Lizard peninsula and Shropshire are in error, the plants being finely dissected forms of (40).

CONSERVATION STATUS: A rare plant which could possibly be lost through being shaded out or by afforestation.

COMPARE WITH:

(40) **A. adiantum-nigrum** which for the most part lacks the finely drawn out (caudate) tips to the pinnae and leaf apex and is somewhat thicker and more rigid. The size of the spores is a helpful check, but 30 should be measured;

(40 x 41) **A. x ticinense** is difficult to distinguish but will have abortive spores; it will only be found with the parents.

42 Lanceolate Spleenwort

Asplenium obovatum Viv.
subsp. *lanceolatum* P. Silva

LEAVES 10-30 cm long.

LEAF-BLADE
lanceolate, 2-pinnate,
shiny, deep mid-green.

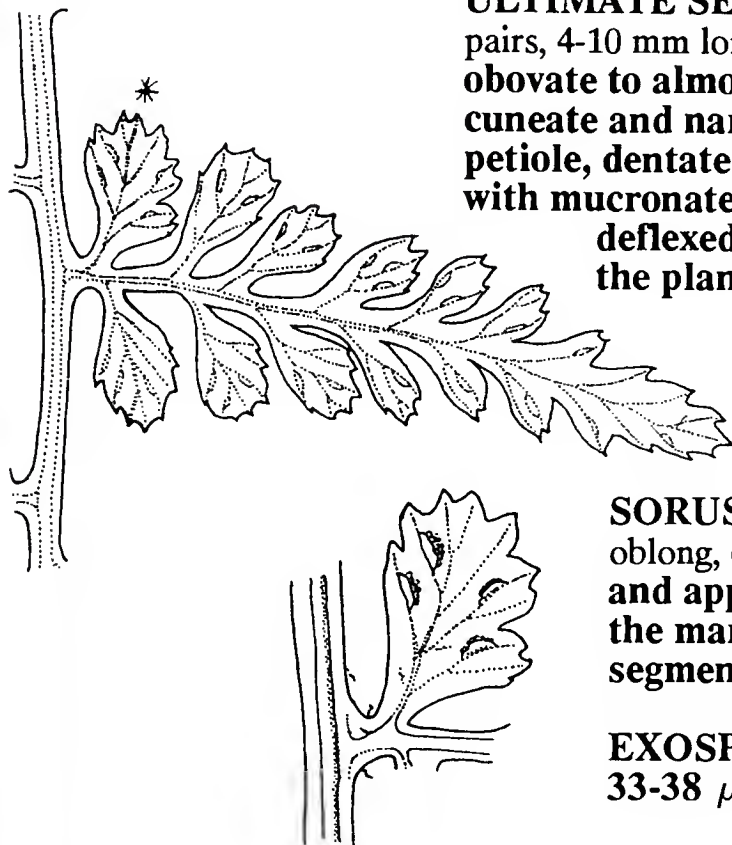


PINNAE up to 20 pairs, up to 4 cm long, (**the lowest pair shorter than the one above it**), **linear-lanceolate to oblong**, pinnate below, pinnatisect above, apex \pm blunt.

STIPE c. $\frac{1}{3}$ - $\frac{1}{2}$ length of leaf (longer if plant in a crevice), dark red-brown, shiny, glabrous, **persistent and becoming paler when leaf dies.**

SCALES on stipe base and rhizome growing point narrowly triangular-lanceolate, **purple-brown metallic lustre.**

HABIT: A plant with a short-creeping, often much-branched rhizome, giving rise to a compact tuft of old stipes and leaves which are initially herbaceous but later \pm leathery and persistent; in exposed situations bent back onto the rock surface; wintergreen.



ULTIMATE SEGMENTS up to 10 pairs, 4-10 mm long, **ovate or obovate to almost orbicular**, base **cuneate** and narrowed into a **petiole**, **dentate towards the apex** with **mucronate teeth**; often **deflexed backwards from the plane of the pinnae**.

SORUS 1-2 mm, linear-oblong, **on lateral veins** and **appearing closer to the margin** than the **segment midrib**.

EXOSPORE length 33-38 μm (x 400).

HABITAT: Predominantly a maritime plant normally found on base-poor rocks or soils over grits and igneous rocks, exposed to salt-laden winds which must provide the required salts. Rarely on inland drystone walls exposed to prevailing winds. Occasionally found in the Channel Isles on hedgebanks, with (40).

DISTRIBUTION: The Channel Isles and the SW peninsula as far east as Portland Bill; through maritime Wales and Snowdonia, isolated sites in Cumbria, Kintyre, W Sutherland and in S Ireland.

CONSERVATION STATUS: Coastal sites not vulnerable; lost from some inland sites possibly by herbicide spraying. **Protected in the Republic of Ireland** under the *Flora (Protection) Order, 1980*.

COMPARE WITH:

(40) *A. adiantum-nigrum* for which, see that species.

A. obovatum subsp. *obovatum* has not been found in the British Isles, but might reach the Channel Isles and our southern shores. It has shorter, more ovate pinnae with fewer pinnules; its spore size (28-32 μm) can confirm its identification. Young sterile plants of (42) can be very similar, but the guard-cell length will be 41-50 μm not 53-64 μm .

43 Sea Spleenwort

Asplenium marinum L.



LEAVES up to 20 cm
(sometimes longer if in a
sheltered crevice).

LEAF-BLADE
lanceolate, 1-pinnate,
tapered to a pinnatifid
± acute apex, bright
mid-green, glossy above,
matt and paler beneath,
rigid, fleshy.

PINNAE up to 3 cm
long, rhomboid-
oblong, base cuneate,
apex rounded, well
spaced or sometimes
crowded and ±
overlapping, margin
crenate;
lowest pinnae
sometimes lobed.

RACHIS green,
narrowly winged.

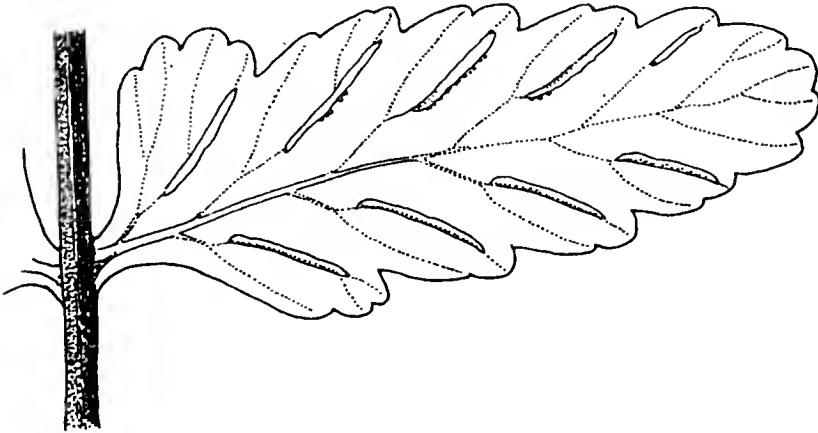
STIPE shiny, purplish
brown.

SCALES narrowly
triangular, lustrous,
purple-grey.

HABIT: A tufted plant, leaves arising from a short, ascending
rhizome, usually appressed to the rock surface; wintergreen.

SORUS linear-oblong.

INDUSIUM with entire margin, persistent.



HABITAT: A species tolerant of being regularly washed with salt spray, and found on vertical cliffs and ledges of various hard rocks on often very exposed shores, associated with Sea Plantain and maritime lichens. Obviously not dependent on salt as found inland, albeit very rarely, usually on calcium/magnesium-bearing rocks. Very sensitive to frost and absent from colder eastern coasts.

DISTRIBUTION: Around the coast of Britain from the Isle of Wight westwards, becoming less common on the east coast of Britain and no further south than Scarborough, Yorks; around the Irish coast but less common on the east. Rare inland populations occur in Derbyshire and Fermanagh.

CONSERVATION STATUS: In no way endangered.

COMPARE WITH:

A morphologically distinctive fern amongst all European *Asplenium* species although the following (albeit very rare) hybrid does show some similarities:

(42 x 39) *A. x microdon* may have similar cutting in the lower part of the leaf, but the wide *scolopendrium*-like apex and thinner texture is distinct.

44a Delicate Maidenhair Spleenwort

Asplenium trichomanes L.

subsp. *trichomanes*



A complex of plants which show considerable variation depending on whether they are growing in exposed or sheltered conditions. Three subspecies have been recorded from Britain and although they can only be identified *with certainty* by their spore or stomata sizes or chromosome number, we have given significant characteristics in bold below.

LEAVES up to 20 cm long.

LEAF-BLADE linear to elliptical or narrowly lanceolate, 1-pinnate, tapered, sometimes abruptly, to a toothed or lobed terminal leaflet, thin and herbaceous in texture, mid-green.

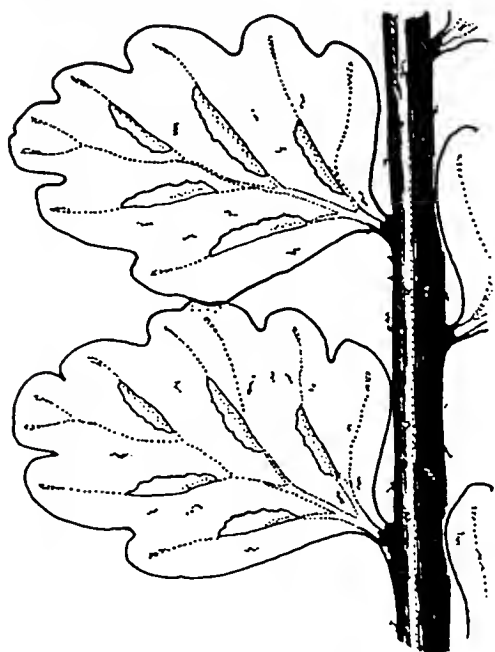


RACHIS black-brown, becoming red-brown (except at the very apex which is green), with a very narrow longitudinal wing running down either side.

STIPE glossy, at first black-brown, **rapidly becoming thin, wiry, bronze-red-brown, persistent long after the pinnae have been shed.**

Longest SCALES 3.5 mm with a central red-brown stripe (best seen in liquid medium).

HABIT: An often densely tufted plant, **with the leaves more usually arching away from the substrate**; remaining green throughout the winter and often for 2-3 years, the pinnae eventually dropping leaving what soon becomes a dense tuft of persistent stipes and rachises with the new leaves emerging through the mass.



PINNAE up to 8 mm long, orbicular (in exposed sites) to oval or rhombic and asymmetric (in more sheltered sites), with a distinct stalk, more widely spaced than (44b), mostly alternate, those in the upper part obliquely inserted, distinctly longitudinally ridged, often curling under along the wavy margin whilst turning up at the apex.

SORUS up to 2 mm long, 4-6 per pinna.

INDUSIUM narrow and delicate.

EXOSPORE length 28-32 μm (x 400).

STOMATA: mean guard-cell length 32-40 μm (x 400).

HABITAT: A definite calcifuge on acid (i.e. silicious) rock faces in crevices and narrow ledges, drystone walls where completely free of mortar, and on well-drained shaded banks by roads, trackways and streams; from sea-level to c. 800 m (2500 ft.).

DISTRIBUTION: Restricted to acid rock areas of Wales, the Lake District and Scotland; recorded only in Co. Down in Ireland. Under-recorded due to difficulty of identification.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(44b) *A. trichomanes* subsp. *quadrivalens*.

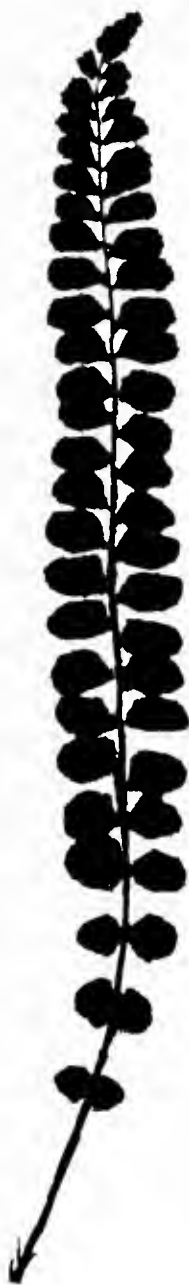
(44c) *A. trichomanes* subsp. *pachyrachis*.

Both these subspecies have larger spores and stomata, but see under (44c) for a further diploid taxon with small spores which may occur in Britain.

44b Common Maidenhair Spleenwort

Asplenium trichomanes L.

subsp. *quadrivalens* D.E. Meyer emend. Lovis



LEAVES up to 20 cm long.

LEAF-BLADE linear to elliptical or narrowly lanceolate in outline, 1-pinnate, tapered, sometimes abruptly, to a toothed or lobed terminal leaflet, thin and herbaceous in texture, mid-green.

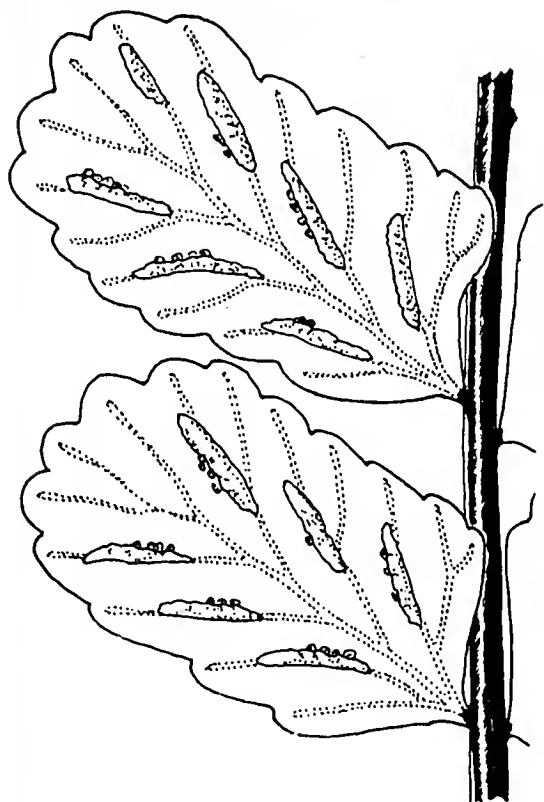
RACHIS black-brown (except at the very apex which is green), with a very narrow longitudinal wing running down either side.

STIPE thick, glossy, black-brown or dark brown and remaining so throughout the season, eventually becoming dull, often persistent but less so than in (46a), the dead leaf tending to break off just above stipe base.



Longest SCALES 5 mm with a central dark brown stripe (best seen in liquid medium).

HABIT: A less densely tufted plant than (46a), with the leaves usually appressed to the substrate in a sinuous manner when in more exposed situations and in rock crevices; remaining green throughout the winter as in (46a), but the pinnae more often remaining attached until the leaf dies and breaks away.



PINNAE up to 11 mm long, more crowded than in (44a) (but spread in shady situations), oblong (even in exposed sites), symmetrical, almost sessile, mostly opposite with a square insertion, lacking longitudinal ridges, the lateral margins tending to roll under but the apex flat.

SORUS up to 3 mm long, 4-9 (-12) per pinna.

INDUSIUM broad, conspicuous and more persistent than (44a).

EXOSPORE length 32-38 μm (x 400).

STOMATA: mean guard-cell length 40-48 μm . (x 400).

HABITAT: A calcicole, on limestone, basalt and many other rock types which may have only very low calcium content; in crevices and on narrow ledges, mortared walls, especially those facing SW, and on well-drained rocky banks and stream valleys; from sea-level to c. 800 m (2500 ft).

DISTRIBUTION: Throughout the British Isles, but less frequent in Ireland.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(44a) *A. trichomanes* subsp. *trichomanes* which is a calcifuge and has smaller spores;

(44c) *A. trichomanes* subsp. *pachyrachis* which is so far known only from limestone rocks and has a scalloped margin to the pinnae.

44c Lobed Maidenhair Spleenwort

Asplenium trichomanes L.

subsp. *pachyrachis* (Christ) Lovis & Reichst.

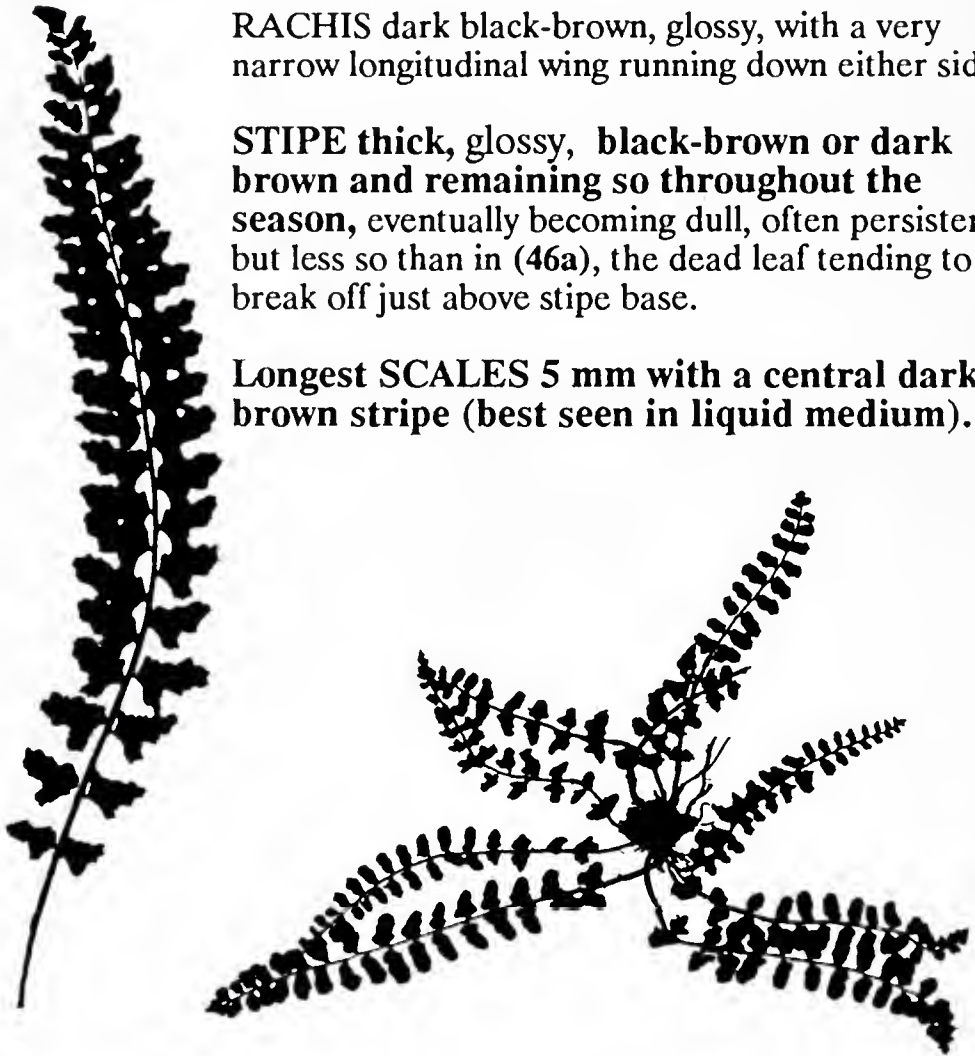
LEAVES up to 12 cm long.

LEAF-BLADE elliptical or narrowly lanceolate, 1-pinnate, tapered, sometimes abruptly, to a toothed or lobed, slender triangular terminal leaflet, thin and herbaceous in texture, mid-green.

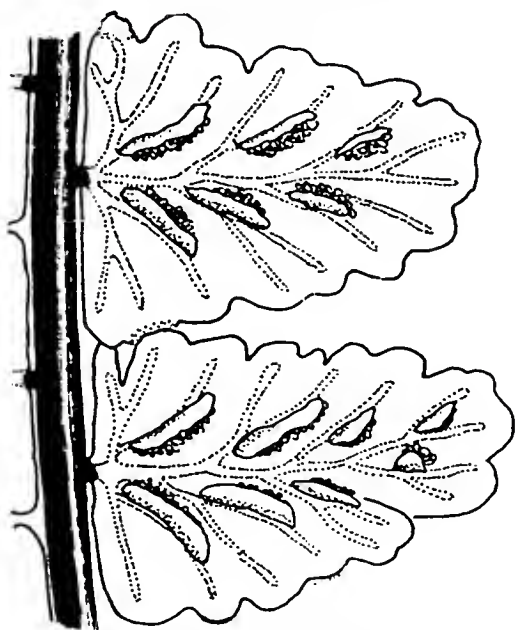
RACHIS dark black-brown, glossy, with a very narrow longitudinal wing running down either side.

STIPE thick, glossy, black-brown or dark brown and remaining so throughout the season, eventually becoming dull, often persistent but less so than in (46a), the dead leaf tending to break off just above stipe base.

Longest SCALES 5 mm with a central dark brown stripe (best seen in liquid medium).



HABIT: An open-tufted plant with the leaves often appressed to the substrate, many showing a characteristic sinuous curve; remaining green throughout the winter and usually not dropping the pinnae, as in subsp. *trichomanes* (44a).



PINNAE up to 11 mm long, often \pm overlapping (but more separated in shady situations), oblong (even in exposed sites) to **subtriangular or even hastate, usually with a distinct auricle on the acroscopic margin**, symmetrical, almost sessile or sometimes shortly stalked, opposite or alternate above, alternate below, with a square insertion, **margin often deeply crenately toothed and wavy.**

SORUS up to 3 mm long, 4-9 (-12) per pinna.

EXOSPORE length 32-38 μm (x 400).

INDUSIUM broad, conspicuous and more persistent than (44b).

STOMATA: mean guard-cell length 40-49 μm (x 400).

HABITAT: On limestone and then usually on more vertical faces and in crevices on steeper rocks; on mortared walls, especially old castles; to c. 230 m (750 ft).

DISTRIBUTION: Recently found in Herefordshire, Gloucestershire, Gwent, with old records also from Merioneth, Yorkshire and Co. Clare.

CONSERVATION STATUS: Over-zealous owners/managers of ancient monuments may remove plants in cleaning operations; the more attractive forms are vulnerable to collection.

COMPARE WITH:

(44b) *A. trichomanes* subsp. **quadrivalens** which is also a calcicole and has spores of a similar size; pinna margin and shape is distinctive;

(45) *A. trichomanes*-**ramosum** in which the leaves are more upright and have green rachises.

A. trichomanes subsp. **inexpectans** Lovis from limestone in S Europe is a very similar plant with often glaucous leaves and a large terminal pinna, but is diploid with smaller spores (27-31 μm); it could be present in Britain.

45 Green Spleenwort

Asplenium trichomanes-ramosum L.



LEAVES up to 18 cm long.

LEAF-BLADE linear, narrowly elliptical or lanceolate, 1-pinnate, tapered gradually (or sometimes abruptly) to a toothed or lobed terminal leaflet, somewhat tapered towards the base, **lower pinnae well-spaced**; thin and herbaceous in texture, pale to apple-green.

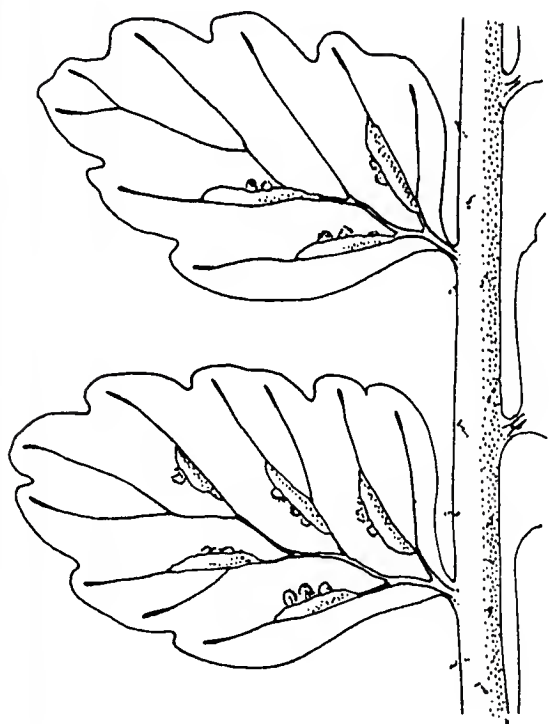
RACHIS green, without a wing.

STIPE dull, green, $\frac{1}{6}$ - $\frac{1}{4}$ leaf length, dark chestnut-brown at the extreme base and this part only persistent on leaf-fall.

Longest **SCALES** 5 mm with a central dark brown stripe (best seen in liquid medium).



HABIT: A tufted plant with the leaves **standing erect or becoming pendulous on vertical rock-faces** from a short branched rhizome, old plants forming large clumps; tending to die down in the winter except in very clement areas.



PINNAE up to 7 mm long, oblong-ovate, those near the leaf base symmetrical, those above less so, shortly stalked, mostly alternate, with a square insertion, distinctly toothed or crenately lobed at the margin.

SORUS up to 2 mm long, 2-6 per pinna.

INDUSIUM broad, conspicuous, persistent.

HABITAT: A calcicole, on limestone, basalt, schists and many other rock types which may have only very low calcium content; on rock-faces, in crevices and on ledges, in grykes of limestone pavement, rarely on mortared walls; in all cases associated with high rainfall, water spray or run-off; mainly in mountains to c. 1000 m (3300 ft).

DISTRIBUTION: In Britain only north of the Severn-Wash line; confined in Ireland to a few high areas with a low mean summer temperature.

CONSERVATION STATUS: Not threatened in Britain, but vulnerable to quarrying in Ireland.

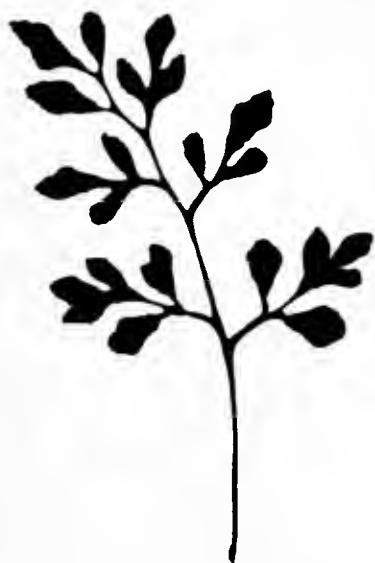
COMPARE WITH:

(44b, 44c) ***A. trichomanes* subsp. *quadrivalens*** and ***pachyrachis***, both of which have dark rachises.

A. adulterinum Milde, a species confined to serpentine in Scandinavia and Central Europe is the fertile result of hybridisation between the above and *A. trichomanes* subsp. *trichomanes* and therefore intermediate in morphology, could exist on serpentine in Britain. It has a purple-brown rachis in the lower half and green above.

46 Wall Rue

Asplenium ruta-muraria L.

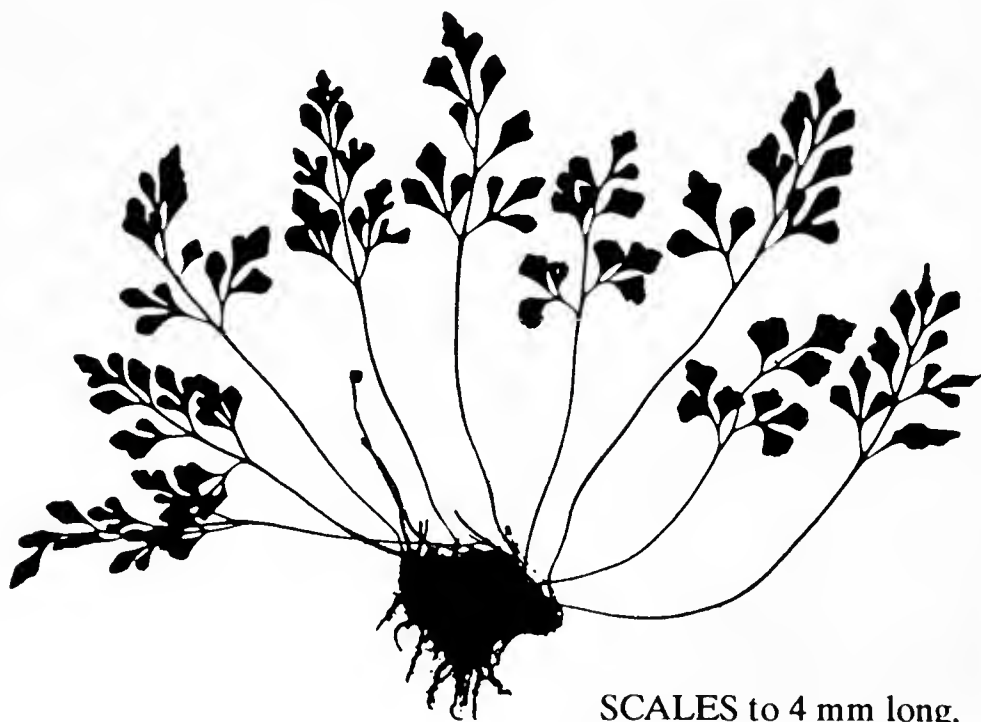


LEAVES up to 8 cm long.

LEAF-BLADE trifoliate in the smallest leaves, to 2- or 3-pinnate, somewhat irregularly dissected in larger leaves, triangular-ovate.

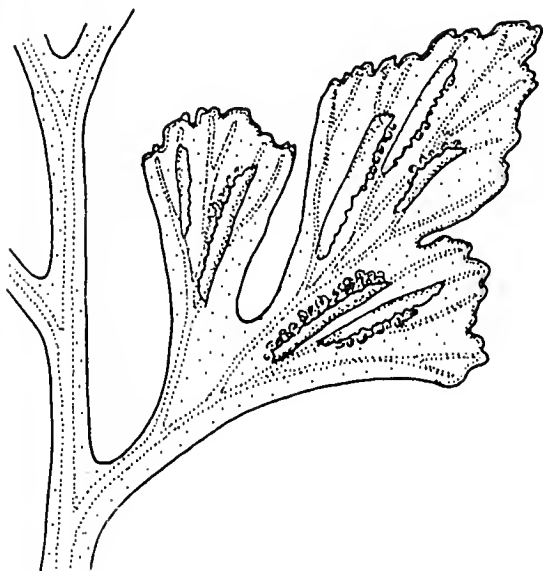
RACHIS and ultimate segment stalks green with occasional stalked glands.

STIPE $\frac{1}{2}$ - $\frac{2}{3}$ leaf length, covered when young with numerous sessile or shortly stalked glands which are lost on maturity, green except at extreme base which is black-brown.



SCALES to 4 mm long, lustrous, bluish-grey.

HABIT: Small tufts of 3 to many erect or ascending leaves arising from a short-creeping rhizome; wintergreen.



ULTIMATE LEAF SEGMENTS up to 8mm long, fan-shaped or rhomboid, to oblanceolate or oblong, thick almost leathery texture, deep bluish green above, paler beneath.

SORUS 1-3 mm long, 2-6 per segment.

INDUSIUM oblong to narrowly linear.

HABITAT: A calcicole common on limestone and in grykes, but found also in crevices of rock-faces in exposed situations, and occasionally on a wide variety of rock types; in maritime areas calcium and magnesium requirements will be fulfilled by salt-laden winds; also on man-made walls, especially churches and bridges; from sea-level to high altitudes of 1000 m (3330 ft).

DISTRIBUTION: Common throughout the British Isles, but scarcer around industrial areas and in the peatlands of N Scotland.

CONSERVATION STATUS: Not threatened, although sensitive to atmospheric pollution.

COMPARE WITH:

Not confused with any other British fern although *A. x murbeckii*, the hybrid with (47), has been recorded and can be similar; it has abortive spores.

Two chromosome races (diploid and tetraploid) occur in *A. ruta-muraria* and have been give subspecific rank. The British material is tetraploid (subsp. *ruta-muraria*); the diploid subsp. *dolomiticum* Lovis & Reichst. is found in central Europe.

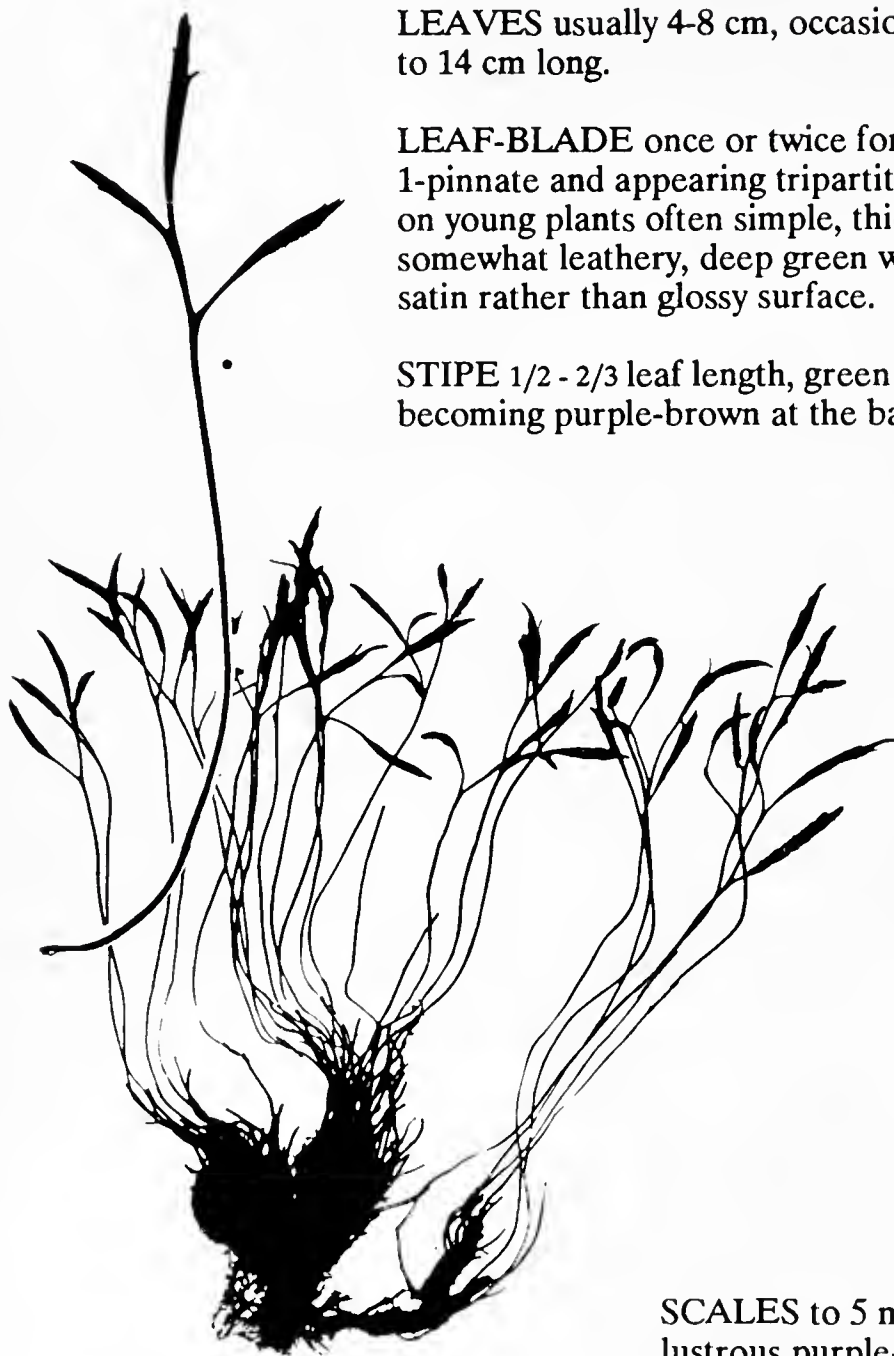
47 Forked Spleenwort

Asplenium septentrionale (L.) Hoffm.

LEAVES usually 4-8 cm, occasionally up to 14 cm long.

LEAF-BLADE once or twice forked or 1-pinnate and appearing tripartite, those on young plants often simple, thick, somewhat leathery, deep green with a satin rather than glossy surface.

STIPE $\frac{1}{2}$ - $\frac{2}{3}$ leaf length, green becoming purple-brown at the base



SCALES to 5 mm, lustrous purple-grey.

HABIT: A tufted plant with leaves arising from many crowns on a short-creeping branched rhizome, often firmly embedded in a rock crevice; leaves being wintergreen persist for many years and may form large clumps.



SEGMENTS up to 20 mm long, 2-4 mm wide, **linear-elliptical or wedge-shaped, drawn to an often jagged or acute apex, tapered below to an elongate (to 10 mm) stalk;** margin with occasional, irregular, acute teeth.

SORUS often 3-4 mm long, appearing linear along segment although on very acutely inserted vein.

INDUSIUM linear, entire.

HABITAT: A calcifuge usually on grits and quartzitic sandstones, and on slates and hard metamorphic rocks totally devoid of calcium or other base salts; occasionally established on drystone walls; sea level to 450 m (1500 ft).

DISTRIBUTION: An uncommon species in Britain, frequent on the Silurian rocks of northern Wales, in the Lake District and N England, and in isolated localities in Scotland, including Rhum and the Ardnamurchan Peninsula; a single native locality in Ireland (W Galway) although introduced in Co. Down.

CONSERVATION STATUS: Not seen in about 40% of recorded sites in the last 30 years and shading of rock-faces by afforestation may be a threat; otherwise the habitat is not vulnerable. **Protected in the Republic of Ireland under the *Flora (Protection) Order, 1980.***

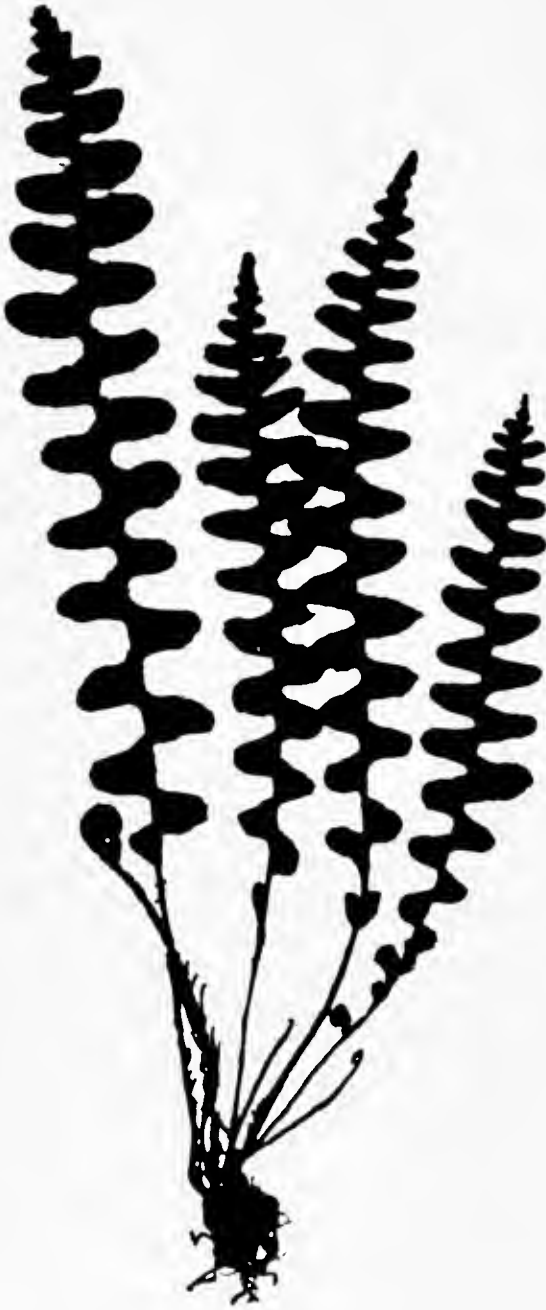
COMPARE WITH:

There is no other similar species in the British Isles, but two hybrids with this species (both of which have abortive spores) have obvious similarities:

(40 x 47) **A. x contrei** has a broader leaf outline, with the two lower pinnae pinnately divided;

(47 x 44a) **A. x alternifolium** has a regularly pinnate, lanceolate or narrowly triangular leaf.

48 Rustyback *Asplenium ceterach* L.



LEAVES up to 18 cm long, **densely covered beneath on both lamina and midrib with scales which are colourless on unfurling leaves, becoming pale reddish brown on maturity.**

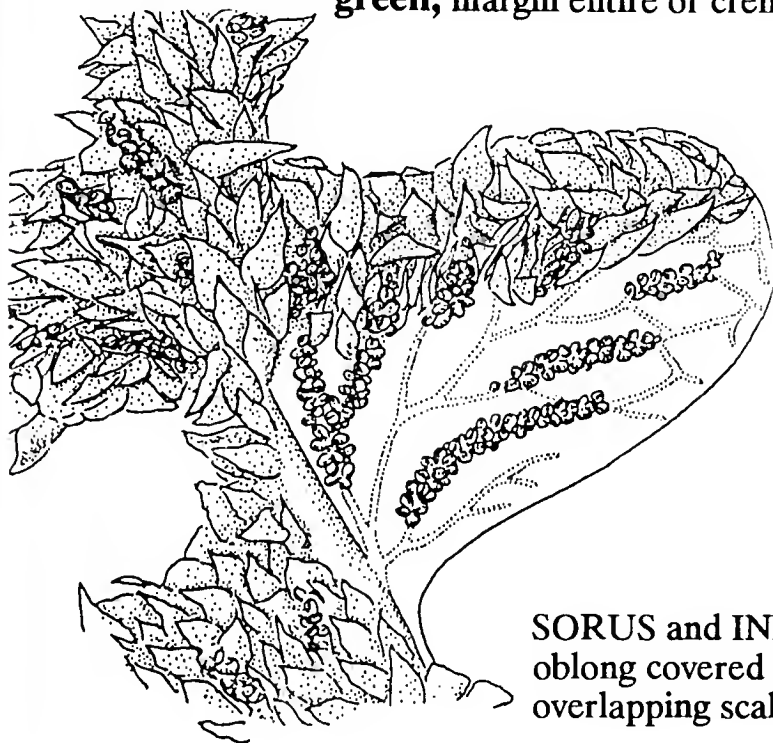
LEAF-BLADE elliptic to oblanceolate, pinnatisect; segments towards apex becoming contiguous and merging into a lobed apex, those at the base widely spaced, **alternate and forming a zig-zag pattern.**

STIPE c. $\frac{1}{4}$ leaf length, densely covered with pale red-brown scales.

SCALES up to 3 mm long, ovate to broadly lanceolate, acuminate at tip, pale reddish brown.

HABIT: A densely tufted plant of several crowns arising from a very short-creeping or ascending rhizome, with many wintergreen leaves. In times of seasonal drought leaves become desiccated and curl inwards exposing the scale-covered underside; when moistened they continue normal growth and activity, and may even develop a second crop of sori amongst the old ones.

LEAF SEGMENTS 8-16 mm long, 4-10 mm wide, oblong, those at the base of the leaf shorter and almost spherical, apex rounded, covered beneath with appressed, overlapping pale red-brown scales, those at the edge standing out as a fringe, upper surface glabrous, dull bluish-green, margin entire or crenate.



SORUS and INDUSIUM linear-oblong covered by the overlapping scales.

HABITAT: A calcicole, common on limestone rocks of all dispositions and on mortared walls, in areas of high rainfall or on walls that face the prevailing winds, in spite of its ability to withstand drought. Lowland to c. 200 m (600 ft) altitude, although occasionally higher; a species of southern Atlantic affinities.

DISTRIBUTION: In SW England and Wales and the Lake District, scattered in the Pennines and SW Scotland but very rare north of the Grampian Highlands and east of the Pennines in England; common throughout Ireland except in northern counties.

CONSERVATION STATUS: Not threatened in its native habitats but vulnerable to rebuilding etc. of man-made substrates at the edge of its range.

COMPARE WITH:

A distinct species not confused with any other in the British flora.

39-48 Hybrid Spleenworts

The following spleenwort hybrids have been found in the British Isles:

- A. x alternifolium* Wulfen
= (47) *A. septentrionale* x (44a) *A. trichomanes*
subsp. *trichomanes*
- A. x clermontae* Syme
= (46) *A. ruta-muraria* x (44b) *A. trichomanes*
subsp. *quadrivalens*
- A. x confluens* (T. Moore ex Lowe) Lawalrée
= (39) *A. scolopendrium* x (44b) *A. trichomanes*
subsp. *quadrivalens*
- A. x contrei* Callé, Lovis & Reichst.
= (40) *A. adiantum-nigrum* x (47) *A. septentrionale*
- A. x jacksonii* (Alston) Lawalrée
= (40) *A. adiantum-nigrum* x (39) *A. scolopendrium*
- A. x microdon* (T. Moore) Lovis & Vida
= (42) *A. obovatum* ssp. *lanceolatum* x
(39) *A. scolopendrium*
- A. x murbeckii* Dörfler
= (46) *A. ruta-muraria* x (47) *A. septentrionale*
- A. x samiense* Sleep
= (40) *A. adiantum-nigrum* x (42) *A. obovatum*
subsp. *lanceolatum*
- A. x ticinense* D. E. Meyer
= (40) *A. adiantum-nigrum* x (41) *A. onopteris*
- A. trichomanes* nothosp. *lusaticum* (D.E. Meyer)
Lawalrée
= (44a) *A. trichomanes* subsp. *trichomanes* x
(44b) *A. trichomanes* subsp. *quadrivalens*
- A. trichomanes* nothosp. *staufferi* Lovis & Reichst.
= (44b) *A. trichomanes* subsp. *pachyrachis* x
(44c) *A. trichomanes* subsp. *quadrivalens*

All the hybrids listed above are rare and several have been found only once. They are all intermediate in morphology between their parents and can be confirmed by their abortive, shrivelled spores.

A. x alternifolium occurs in several counties in N Wales, Cumbria and southern Scotland where the parents grow together but at no site is it frequent nor as well established as this hybrid can be in mainland Europe. It is likely that some hybrids between the commoner species (e.g. *A. x jacksonii*, *A. x samiiense*) may be more frequent than records suggest. The former is quite distinctive in its morphology, but the latter can be very similar to the variable *A. adiantum-nigrum*.

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	sep	■			‡	■		‡		■	
cet		‡									

■ hybrids recorded in the British Isles

‡ hybrids recorded in continental Europe that may be found in the British Isles

49 Lady Fern

Athyrium filix-femina (L.) Roth



LEAVES up to 120 cm; a very variable plant in its leaf cutting and texture which has produced a number of attractive cultivars.

LEAF-BLADE

elliptic-lanceolate, tapered somewhat abruptly to an acuminate apex, 2- or 3-pinnate; **dull, mid- to somewhat blue-green.**

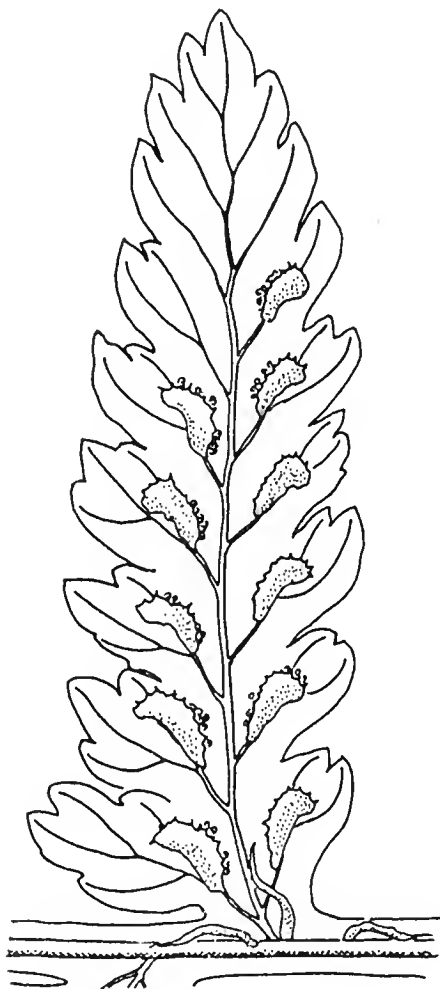
PINNAE linear-lanceolate, tapered to a fine apex, truncate below, the lowest pinnules touching the rachis, alternate and contiguous above, decrescent and \pm opposite and remote below.

RACHIS green, or **purplish red**, a character which appears to breed true but has no taxonomic significance, scaly towards base.

STIPE $1/4 - 1/2$ leaf length, coloured as rachis, densely scaly at base.

SCALES to 10 mm, triangular-lanceolate, entire, dark brown to pale straw-coloured.

HABIT: Leaves arising from an erect rhizome forming a dense 'shuttlecock'; dying down with the earliest frosts.



PINNULE length often very variable along pinna, linear-lanceolate, apex obtuse to acute, pinnatisect, or in some forms pinnate-pinnatifid.

SORUS oblong to linear, close to vein, those on larger pinnules often J-shaped, straddling the vein.

INDUSIUM linear, oblong or J-shaped, membranous (x 10).

SPORES minutely scabrid (x 400).

HABITAT: A plant that likes to have its roots in moving water and thus found near streams and in wet hollows in shady woods, and on hillsides and in 'lazy-bed' channels in the open in W Scotland and areas of higher rainfall.

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(50) **A. distentifolium**, which has a flatter, more yellow-green leaf, and lacks an indusium;

(38) **Oreopteris limbosperma**, the leaf of which is glandular, lemon-scented, less cut and has many decrescent pinnae down the length of the stipe; its sori are marginal and lack obvious indusia.

50a Alpine Lady Fern
Athyrium distentifolium Tausch ex Opiz
var. *distentifolium*



LEAVES up to 75 cm.

LEAF-BLADE elliptic-lanceolate, tapered to an acuminate apex, 2- or almost 3-pinnate, **pale to yellowish green, the margins of the ultimate segments touching giving a less lacy appearance** than in (49).

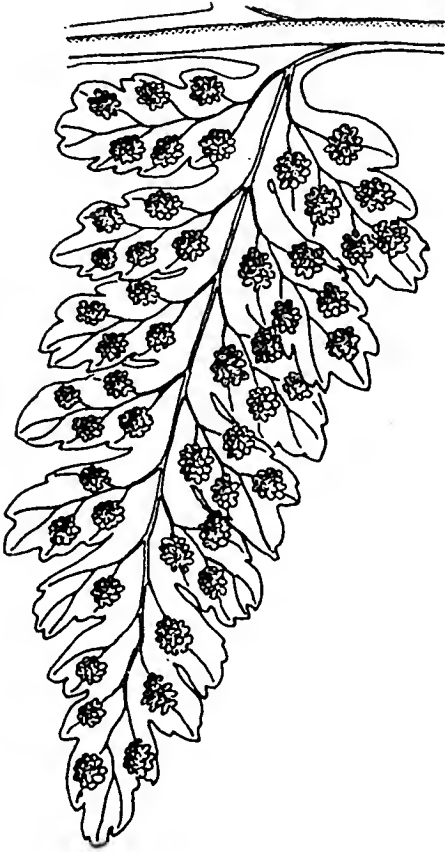
PINNAE linear-lanceolate, tapered to a fine apex, truncate below, the lowest pinnules touching the rachis, alternate and contiguous above, decrescent and \pm opposite and remote below.

RACHIS **pale yellow-green, almost translucent, scaly** towards base.

STIPE c. 1/4 length of leaf, coloured as rachis becoming pinkish or straw-coloured at base, usually densely scaly.

SCALES to 10 mm triangular-lanceolate, entire, pale straw to buff.

HABIT: Leaves arising in dense 'shuttlecocks' from an erect, branched rhizome forming often large clumps of many crowns; turning brown and dying down in winter but possibly more resistant to frost than *A. filix-femina*.



PINNULE length
± uniform, linear-lanceolate, apex obtuse to acute, pinnatisect.

SORUS ± round and appearing more uniformly arranged on the pinnule than in (50b).

INDUSIUM imperfectly formed or absent, occasionally seen on very young leaves as a rudimentary scale and soon lost.

SPORE wall with fine ridges (x 400).

HABITAT: An alpine plant, occurring between 550-1100 m (1800-3600 ft) on the more acid range of rock types, in gullies, on ledges and block screes and especially in N-facing corries where snow lies late into the season, or where spring melt-water percolates.

DISTRIBUTION: Scotland only, on isolated mountains in the NW and in the W-Central Highlands, but becoming rare in the eastern Grampians.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

- (49) ***A. filix-femina***, which has fewer crowns, a more finely-cut and darker, blue-green leaf, linear or J-shaped sori with an indusium, and minutely scabrid spores;
(38) ***Oreopteris limbosperma***, the leaf of which is glandular, lemon-scented, less cut and has many decrescent pinnae down the length of the stipe; its sori are marginal and almost contiguous.

50b Flexile Alpine Lady Fern

Athyrium distentifolium Tausch ex Opiz

var. *flexile* (Newman) Jermy



LEAVES up to 35 cm.

LEAF-BLADE \pm elliptic, tapered gradually to an acute apex, 2-pinnate, pale to yellowish-green.

PINNAE linear-lanceolate to sub-triangular, abruptly tapered to a subacute or obtuse apex, alternate, well-spaced throughout, lower pinnae often deflexed, not markedly decrescent.

RACHIS yellow-green or reddish, scaly towards base.

STIPE c. 1/5 or less length of leaf, coloured as rachis, markedly deflexed just below the blade, usually densely scaly.

SCALES to 10 mm, triangular-lanceolate, entire, pale straw to golden.

HABIT: Leaves arising in loose, often flattened, 'shuttlecocks' from an erect, branched rhizome; dying down in winter. The deflexed habit of this variety has lead to much speculation as to the role of the environment in determining leaf form. However, plants brought into cultivation have retained their morphology which suggests that the difference is genetical. Nevertheless, we feel the difference does not merit more than varietal status.



PINNULE length
± uniform, ovate-oblong,
widely spaced, pinnatifid
or coarsely toothed, apex
obtuse, often tridentate.

SORUS ± round, often with
fewer sporangia and less
uniformly arranged on the
pinnule than (50a); sori
frequently in the lower 1/2 of
the leaf only.

INDUSIUM as in (50a).

SPORES as in (50a).

HABITAT: An alpine plant, only occurring above 900 m (3000 ft) on similar acid rocks as in (50a), in gullies, on ledges and between blocks in screes, especially in N-facing corries.

DISTRIBUTION: Scotland only, on isolated mountains in the NW and W-Central Highlands.

CONSERVATION STATUS: Habitat not threatened, but the variety is rare and should not be collected.

COMPARE WITH:

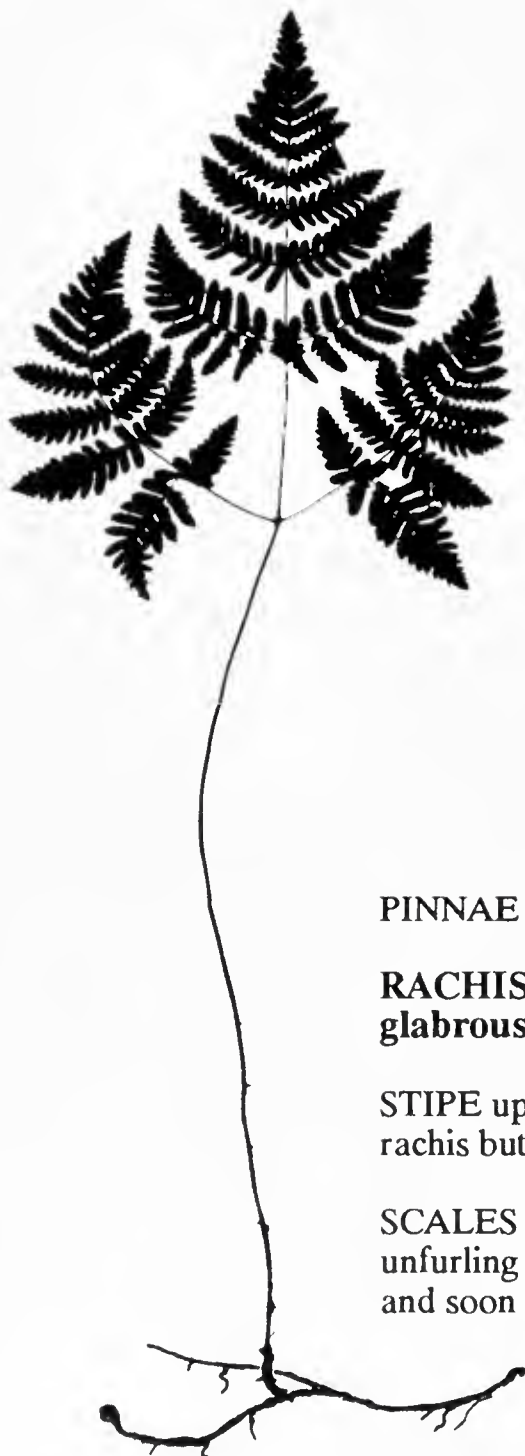
(50a) *A. distentifolium* var. *distentifolium* for which see that variety;

(49) *A. filix-femina* which can have a similar stature and size to this taxon, has a more finely-cut, denser and darker green leaf, and linear or J-shaped sori with an indusium;

(38) *Oreopteris limbosperma*, the leaf of which is glandular, lemon-scented and less cut, and the indusia are marginal and throughout the leaf.

51 Oak Fern

Gymnocarpium dryopteris (L.) Newman



LEAVES up to 40 cm long, the blade inclined backwards, almost horizontal; the fertile leaves sometimes having slightly narrower pinnules and segments, and often longer stipes.

LEAF-BLADE up to 18 cm long, 24 cm wide, 2-pinnate-pinnatisect, broadly triangular, tripartite, lowest pinnae pair almost equal in size and replicas of the remainder of the blade, **rich mid-green, soft, thin, dull, glabrous and non-glandular.**

PINNAE linear-lanceolate, apex acute.

RACHIS very slender, brittle, pale green, **glabrous and non-glandular.**

STIPE up to $\frac{2}{3}$ leaf length, similar to rachis but with few scales at base.

SCALES colourless on rhizome apex and unfurling leaves, becoming pale brown and soon lost from the young leaves.

HABIT: A plant with a wiry, slender, subterranean, much branched creeping rhizome from which the leaves arise singly to form large clonal colonies; dying down in late autumn.



PINNULES 5-12 x 3-7 mm, lobed to pinnatifid, those towards the base of the lowest pinnae pinnatisect; linear-oblong to lanceolate, apex rounded or obtuse.

SORUS 1-2 mm, round, nearer the margin of the segment than the mid-vein, without an indusium.

HABITAT: In open woodland, lightly shaded ravines, along mountain streams, on peaty banks amongst heather and other dwarf shrubs where there is occasional flushing of mineral-rich water; requires a cool moist climate and a cold winter period.

DISTRIBUTION: Throughout Scotland, upland England and Wales with a few scattered populations in the south and east; very rare in Ireland, now only recorded for Antrim.

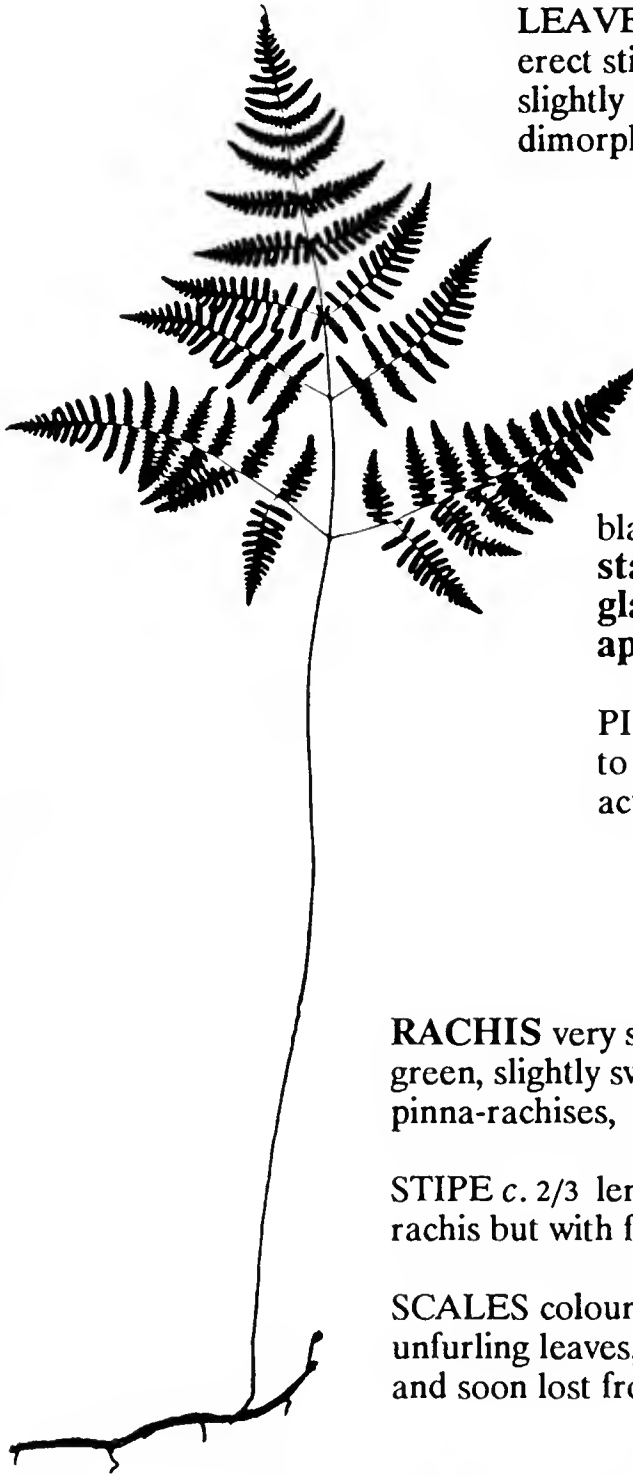
CONSERVATION STATUS: Threatened on the edge of its range in lowland England by habitat clearance affecting microclimate or water regime. Protected in Northern Ireland by the *Wildlife (NI) Order, 1985*.

COMPARE WITH:

(52) **G. robertianum** has a narrower, scarcely tripartite, glandular leaf of a grey-green colour with a distinctive smell of apples, even in very young specimens.

52 Limestone Oak Fern

Gymnocarpium robertianum (Hoffm.) Newman



LEAVES up to 45 cm long, with erect stipes and the blade inclined slightly backwards; lacking the dimorphism seen in (51).

LEAF-BLADE

2-pinnate-pinnatisect, broadly triangular, up to 22 cm long, 20 cm wide, lowest pair of pinnae well developed but not equal in size to the remainder of the

blade, **grey-green, with stalked and sessile glands giving a mealy appearance.**

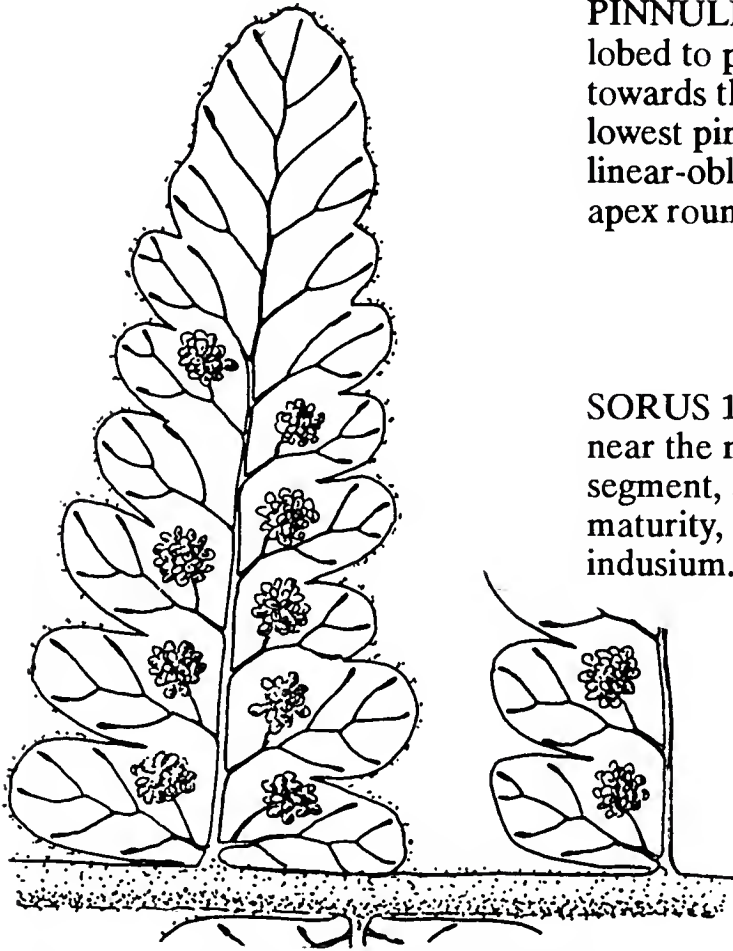
PINNAE linear-lanceolate to narrowly triangular, apex acute.

RACHIS very slender, brittle, pale olive-green, slightly swollen at junction with pinna-rachises, **glandular.**

STIPE c. $\frac{2}{3}$ length of leaf, similar to rachis but with few scales at base.

SCALES colourless on rhizome apex and unfurling leaves, becoming pale brown and soon lost from young leaves.

HABIT: A plant with a slender, subterranean, branched creeping rhizome from which the leaves arise singly, occasionally forming large colonies; dying down in the autumn.



PINNULES 5-12 x 3-7 mm, lobed to pinnatifid, those towards the base of the lowest pinnae pinnatisect; linear-oblong to lanceolate, apex rounded or obtuse.

SORUS 1-2 mm, round, near the margin of the segment, almost confluent at maturity, without an indusium.

HABITAT: A plant of more open habitats than the last species, found on limestone pavements, screes, rock ledges and other rocky habitats including old or dilapidated drystone walls; always associated with calcium-rich substrates.

DISTRIBUTION: Scattered throughout England and Wales on chalk and limestone areas, occasionally occurring as an adventive on walls; in Scotland only in isolated localities in Perth and W Sutherland; in Ireland only in E Mayo.

CONSERVATION STATUS: Threatened in some areas by quarrying although recolonisation of old quarries possible. Protected in Ireland by the *Flora (Protection) Order, 1980*.

COMPARE WITH:

(51) *G. dryopteris* has a somewhat broader, distinctly tripartite, non-glandular, glabrous leaf of a rich mid-green colour.

53 Brittle Bladder Fern

Cystopteris fragilis (L.) Bernh.



LEAVES 10-25 cm (or more if growing luxuriantly or in crevices), usually \pm erect.

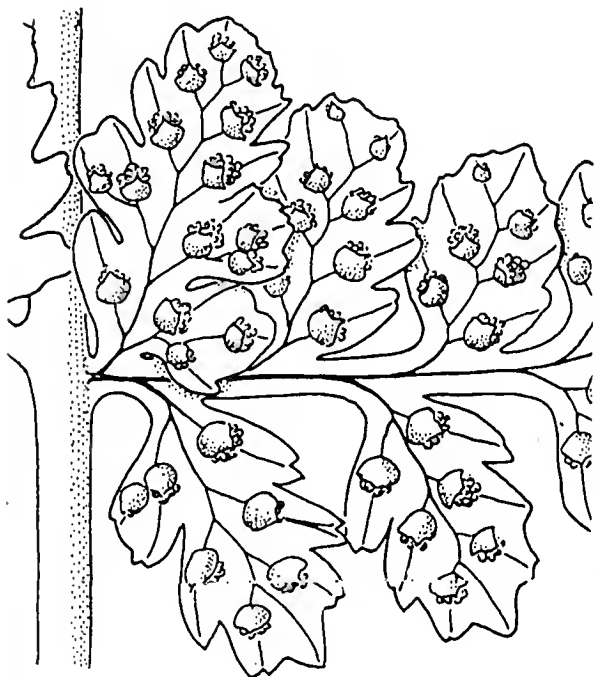
LEAF-BLADE elliptic-lanceolate, tapering below, apex acute, 2-pinnate, dull, mid to deep green; **the degree of leaf dissection appears to be correlated with chromosome number: those plants with more dissected leaves are usually hexaploid.**

PINNAE narrowly triangular to lanceolate, often widely spaced, more rarely just touching, \pm in the same plane as the blade.

STIPE very slender, brittle, pale green, black at the base $\frac{1}{3}$ - $\frac{1}{2}$ leaf length.

SCALES very sparse at base of stipe, c. 1-2 mm long, lanceolate-triangular, clathrate, grey-brown.

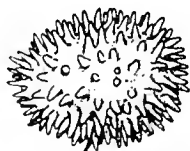
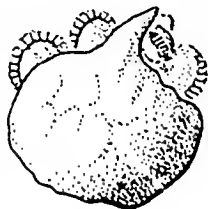
HABIT: Leaves arising in an open cluster at the ends of a short-creeping, occasionally branched rhizome; leaves become pale yellow and fall in the autumn.



PINNULES pinnatifid or pinnatisect; ultimate segments lobed or bluntly toothed, teeth usually rounded or very occasionally retuse.

SORUS \pm round, borne slightly nearer the margin than the midrib **on a vein that runs into the segment apex** (x 10).

INDUSIUM ovoid or pear-shaped, attached at the base, acute or lacerate at the apex, soon shrivelling.



SPORE wall spinulose (seen at x 50, but better at x 400).

HABITAT: A plant of shady moist crevices, under overhangs, etc., where seepage water percolates; most frequent on limestone and calcium-bearing rocks, and on mortared brick or stone walls when in permanent shade.

DISTRIBUTION: Throughout the British Isles, but rare in both SE England and SE Ireland, usually through lack of suitable habitats.

CONSERVATION STATUS: Not threatened, but lost from 134 squares in Britain and 60 in Ireland over the past 30 years.

COMPARE WITH:

(49, 50) **Athyrium** species, which, when in the sporeling stage, can be mistaken for *Cystopteris*; their lower pinnae are usually more decrescent and they are less cut;

(54) **Cystopteris dickieana** which has non-spiny spores and usually broader leaf segments.

54 Dickie's Bladder Fern

Cystopteris dickieana R. Sim



LEAVES 10-20 cm long, somewhat arching.

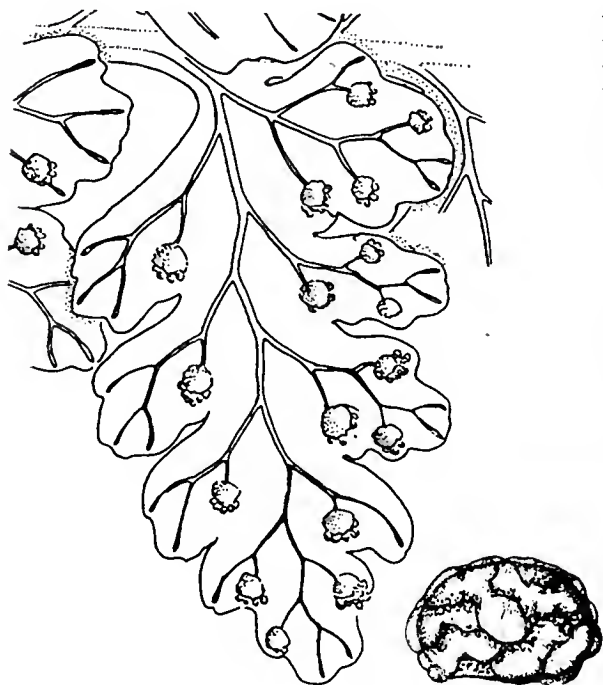
LEAF-BLADE broadly oblong-lanceolate, tapering slightly below, apex acute but not tapered, 2-pinnate, dull, mid- to bluish-green.

PINNAE c. 1.5-3 cm, triangular, becoming ovate-oblong towards apex of blade; pinnate-pinnatisect, **usually oblique to the plane of the leaf (as a Venetian blind).**

STIPE very slender, brittle, pale green, black at the base, $\frac{1}{4}$ - $\frac{1}{3}$ leaf length.

SCALES very sparse at base of stipe, c. 1-2 mm long, lanceolate-triangular, clathrate, grey-brown.

HABIT: Leaves arising in an open cluster at the ends of a short-creeping, occasionally branched rhizome; leaves become pale yellow and fall in the autumn.



PINNULES pinnatifid or pinnatisect; ultimate segments lobed or bluntly toothed, teeth usually rounded or very occasionally retuse.

SORUS as in (53) but **usually on a vein that runs into a sinus** (x 10).

INDUSIUM as in (53).

SPORE wall wrinkled (rugose) and minutely verrucose (x 400).

HABITAT: A calcicole of coves and sea caves where seepage water percolates and which are washed by salt-bearing winds during storms.

DISTRIBUTION: Known only from the Kincardine/Aberdeen coast, from where it was introduced into British gardens in the 1850's and since widely grown. Surprisingly it rarely escapes into the wild. Reported also from Perthshire and Arran Isles, Ireland, last century but never verified.

CONSERVATION STATUS: **Protected in Britain** under the *Wildlife and Countryside Act, 1981*.

COMPARE WITH:

(49) **Athyrium filix-femina** with which it grows, and which in the sporeling stage can be mistaken for *Cystopteris*, but its lower pinnae are usually more decrescent and less cut;

(53) **Cystopteris fragilis**, in which the spores are spiny and usually the leaf-blade and pinnule segments are narrower.

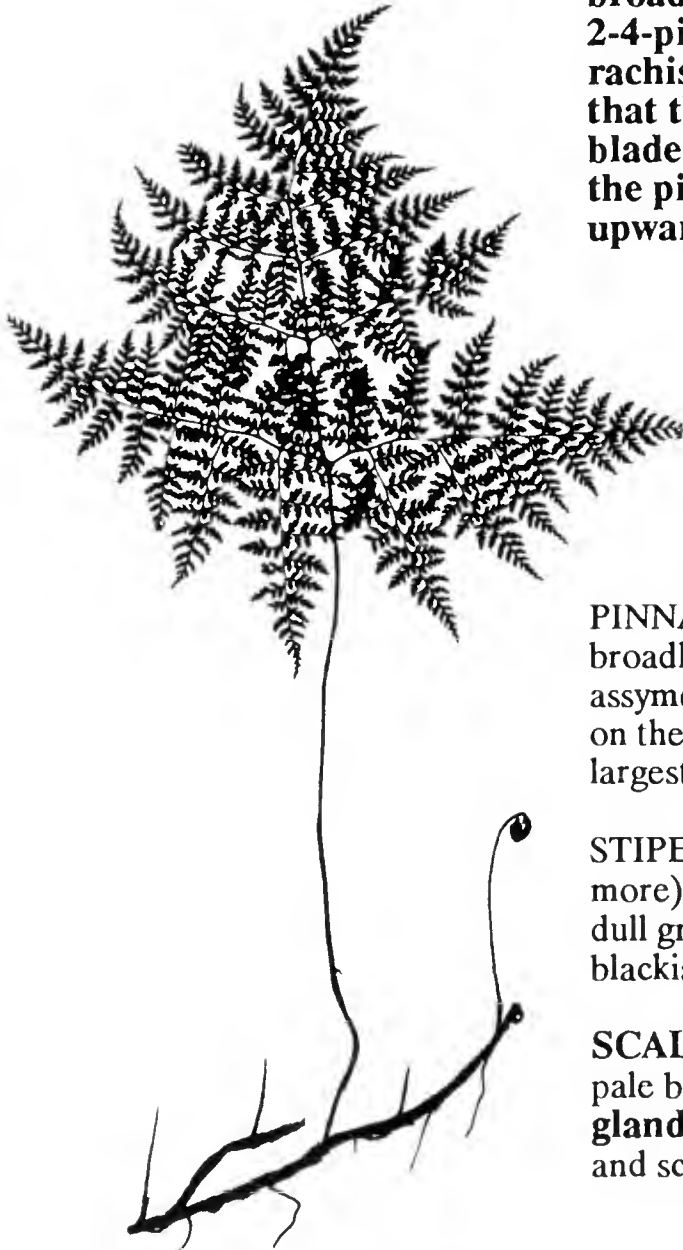
Material of this species from montane areas of mainland Europe lacks the gross leaf morphology of the Kincardine plants and can only be identified with certainty by the spore sculpturing; such plants could occur in the British Isles.

55 Mountain Bladder Fern

Cystopteris montana (Lam.) Desv.

LEAVES 12-25 cm or more.

LEAF-BLADE as wide as long, triangular or broadly ovate, 2-4-pinnate-pinnatisect, rachis often bent back so that the upper half of the blade is oblique but with the pinna-tips curving upward.

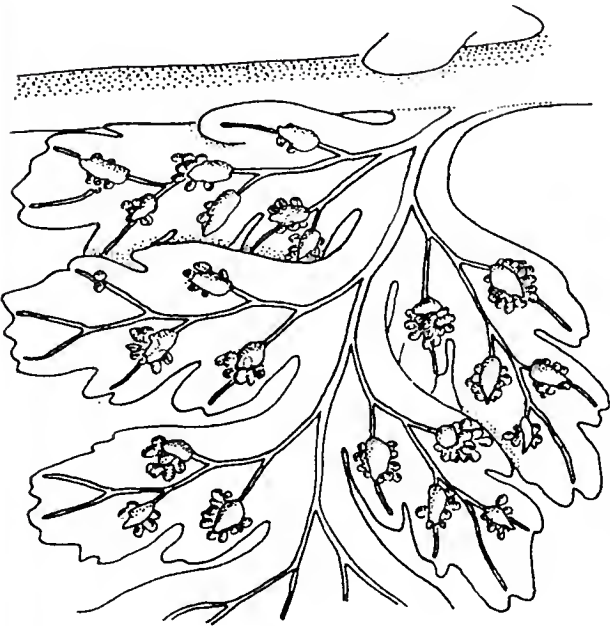


PINNAE triangular to broadly lanceolate, assymetrical, those segments on the basisopic side largest, apex acute.

STIPE slender, often $\frac{2}{3}$ (or more) leaf length, dull green becoming blackish towards base.

SCALES 1-3 mm, clathrate, pale brown, **fringed with glands**, on the rhizome tip and scantily on the stipe.

HABIT: Leaves arising singly from a slender (1-2 mm diam.) much-branched, wide-creeping, dark brown, subterranean rhizome; the leaf-blades frequently orientated along the same axis; not wintergreen.

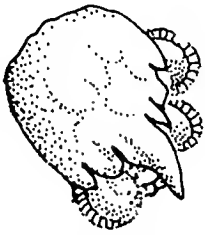


PINNULE SEGMENTS
very finely cut in fertile
leaves, those of sterile leaves
less so.

SORUS \pm round, borne
slightly nearer the margin
than the midrib on a vein
that runs into the segment
apex (x 10).

INDUSIUM ovoid or
pear-shaped, attached at
its base, acute or lacerate
at apex, soon shrivelling.

SPORES with low
rounded protuberances
(x 400).



HABITAT: An alpine plant not found below 700 m (2300 ft), on N-facing ledges, gullies, often unstable and eroded, in sites with a high calcium content, usually where water is constantly seeping.

DISTRIBUTION: A rare plant found mostly in mica schist areas of Forfar, Inverness, Perth and Stirling.

CONSERVATION STATUS: At one time under threat from alpine gardeners; now the most likely threat is from a change to a drier or warmer climate.

COMPARE WITH:

(51) *Gymnocarpium dryopteris*, which has a similar leaf-blade, but is less divided and an intense apple-green colour; it is also rarely found as high as (55);

(69) *Dryopteris expansa*, which can sometimes have a very triangular juvenile leaf and will grow in a similar habitat; it has a tougher texture, a duller yellow-green colour and is less dissected.

56 Oblong Woodsia

Woodsia ilvensis (L.) R. Br.



LEAVES 5-10 (-15) cm long, often adpressed to rock face.

LEAF-BLADE oblong-linear to lanceolate-triangular, apex \pm acute, pinnate-pinnatisect or 2-pinnate at the base, \pm **densely covered with jointed hairs on both surfaces** giving a velvety appearance to younger leaves, dark mid-green, dull.

PINNAE up to 15 mm long, subtriangular to linear-oblong, apex obtuse or rounded, **barely contiguous above**, often widely spaced below; **pinna-midrib with narrow scales**.

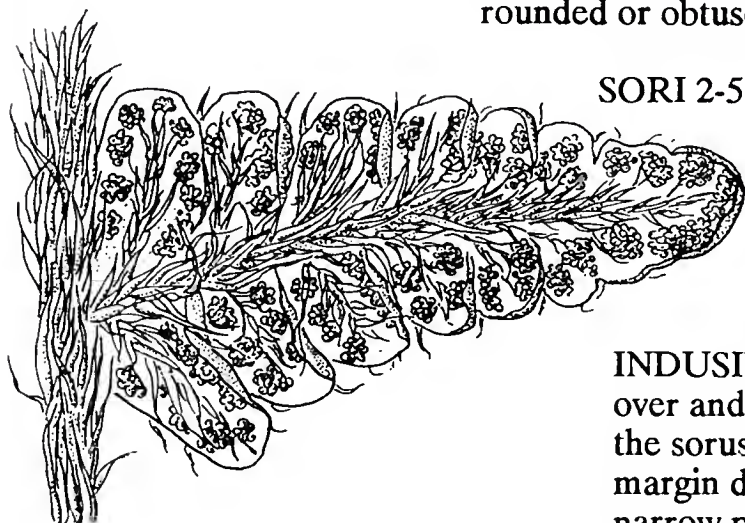
RACHIS \pm **densely covered with scales and hairs**, stramineous to a deeper brown.

STIPE up to 1/3 leaf length, rigid, jointed c. 1/3 of the way up, brown to reddish-brown, **densely scaly**.

SCALES up to 7 mm long, lanceolate-triangular to linear, pale straw-coloured, whitish when young.

HABIT: A tufted plant with few crowns from a branched upright rhizome bearing spreading leaves, often overwintering, eventually breaking off at an abscission zone (termed 'joint' above and a characteristic of the genus), leaving old stipe bases persistent on the rhizome.

ULTIMATE SEGMENTS 6-13,
ovate-oblong to orbicular with a
rounded or obtuse apex.



SORI 2-5 round, indusiate,
often covering
segment.

INDUSIUM initially folded
over and partially covering
the sorus, later rolling back,
margin deeply cut into long
narrow projections often
seen as a fringe encircling
the mature sorus.

HABITAT: An arctic-alpine plant of fissures and narrow ledges on steep or vertical, often E- or S-facing, rock-faces, from 400 m (1200 ft) altitude upwards; on fine-grained silicious, metamorphic and volcanic rocks, tolerant of small amounts of calcium.

DISTRIBUTION: Confined to the mountains of N Wales, the Lake District, the Southern Uplands and in various localities in the Highlands of Scotland.

CONSERVATION STATUS: With the next species, decimated by herbarium collectors at the end of the last century such that extant populations are now so small that they may not be viable without man's intervention. **Protected in Britain** under the *Wildlife and Countryside Act, 1981*.

COMPARE WITH:

(57) **W. alpina** has shorter pinnae more closely spaced towards the leaf apex, with scales on the pinna-midribs. Young plants of (49, 50) **Athyrium** species and (53) **Cystopteris fragilis** can be confused with sterile *Woodsia*, but with magnification the fine scales or hairs will be seen on the unfurling fronds of the latter. If the plant is fertile the three genera can be easily distinguished.

57 Alpine Woodsia

Woodsia alpina (Bolton) S.F. Gray



LEAVES 2-10 (-15) cm long, often adpressed to rock face.

LEAF-BLADE oblong-linear to oblanceolate, apex acute, pinnate-pinnatisect, with **sparse, long, jointed hairs** or almost glabrous on under (abaxial) side, upper (adaxial) side glabrous; pale to mid-green.

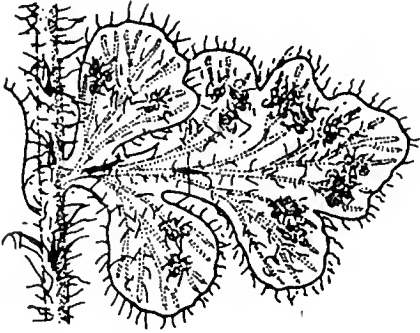
PINNAE up to 8 mm long, subtriangular to ovate, apex obtuse or rounded, \pm crowded above, often widely spaced below; pinna-midrib never scaly.

RACHIS sparsely covered with scales and hairs, stramineous to a deeper brown.

STIPE $\frac{1}{5}$ - $\frac{1}{4}$ leaf length, rigid, jointed c. $\frac{1}{3}$ of the way up, brown to reddish-brown, **sparsely scaly**.

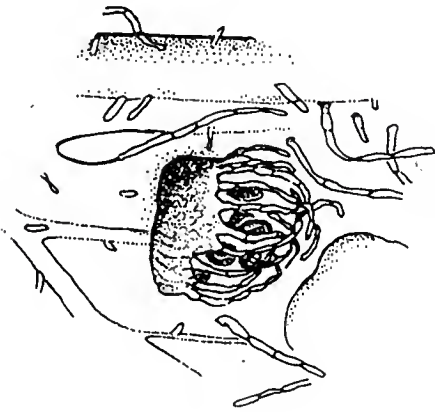
SCALES up to 5 mm long, lanceolate-triangular to narrowly linear, pale straw-coloured, whitish when young.

HABIT: A tufted plant with few crowns forming untidy clusters of spreading leaves which often overwinter, old fronds eventually breaking off at an abscission zone ('joint') leaving old stipe bases persistent on the rhizome.



ULTIMATE SEGMENTS
3-7, obovate-oblong to orbicular with a rounded or obtuse apex.

SORI 2-5 towards the apex of each segment, round, indusiate.



INDUSIUM initially folded over and partially covering the sorus, later rolling back, margin deeply cut into long narrow projections often seen as a fringe encircling the mature sorus.

HABITAT: An arctic-alpine plant of fissures and narrow ledges on steep or vertical, often E- or S-facing, rock-faces, frequently establishing itself initially in a tuft of moss; on silicious, metamorphic and volcanic rocks.

DISTRIBUTION: Confined to the mountains of N Wales and the Highlands of Scotland from Main Argyll east to Forfar, with an old record for Skye.

CONSERVATION STATUS: Decimated by herbarium collectors in the latter half of the last century such that extant populations are now so small that they may not be viable. **Protected in Britain** under the *Wildlife and Countryside Act, 1981*.

COMPARE WITH:

(56) *W. ilvensis* has longer pinnae more widely spaced throughout, scales on the pinna-midribs and hairs on the upper surface of the leaf segments.

Young plants of (49, 50) *Athyrium* species and (53) *Cystopteris fragilis* can be confused with sterile *Woodsia*, but with magnification the fine scales or hairs will be seen on the unfurling fronds of the latter. If the plant is fertile the three genera can be easily distinguished.

58-60 The Shield Ferns

Dryopteridaceae: *Polystichum*

Introduction

Medium to large plants of woods and hedge banks or shady mountain ledges, growing singly or in groups.

Cyrtomium falcatum, a close relative from E Asia and often grown as a houseplant in Europe, is included in this key (see p. 189 for further details). This genus, which is treated by some as a segregate of *Polystichum*, has anastomosing veins and sori scattered irregularly over the wide pinnae.

Characteristics of Polystichum

Stout, erect, scaly rhizome; short, scaly stipes; leaves 1-pinnate-pinnatisect to 2-pinnate, lanceolate to linear; pinnae and pinnules unequally divided with largest lobe on apical side; veins free; sori round, scattered, with thick, centrally attached indusia.

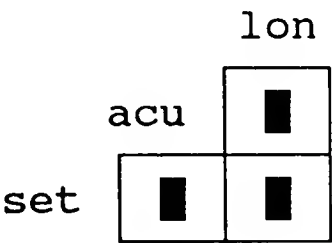
Field key to species

- | | | |
|---|--|--------------------------------|
| 1 | Leaves 1-pinnate | 2 |
| 1 | Leaves 1-pinnate-pinnatisect to 2-pinnate | 3 |
| 2 | Pinnae < 1 cm wide, gradually diminishing towards the leaf apex | lonchitis (58) |
| 2 | Pinnae > 1 cm wide, terminal pinna as large as the lateral ones | Cyrtomium falcatum (A4) |
| 3 | Leaves of variable dissection, 1-pinnate-pinnatisect to 2-pinnate, hard texture, lowest pinnae \pm 1/2 length of middle pinnae | aculeatum (59) |
| 3 | Leaves fully 2-pinnate, soft texture, lowest pinnae \pm equal in length to middle pinnae | setiferum (60) |

Hybrid Shield Ferns

The following hybrid shield ferns (■) have been found in the British Isles:

- P. x bicknellii* (Christ) Hahne
= (59) *P. aculeatum* x (60) *P. setiferum*
- P. x illyricum* (Borbas) Hahne
= (59) *P. aculeatum* x (58) *P. lonchitis*
- P. x lonchitiforne* (Halacsy) Bercherer
= (58) *P. lonchitis* x (60) *P. setiferum*



P. x bicknellii is fairly common and may be found wherever the parents grow close together. It can appear very similar to *P. setiferum*, though is often larger and more vigorous, so confirmation by the presence of abortive spores is essential. The other two hybrids are very rare and very difficult to distinguish from each other. *P. lonchitiforne*, although producing only abortive spores, is the direct ancestor of *P. aculeatum*.

58 Holly Fern
Polystichum lonchitis (L.) Roth

LEAVES 12-50 cm long.



LEAF-BLADE narrowly linear-lanceolate to linear, 1-pinnate, very glossy, dark green, feels tough when stroked.

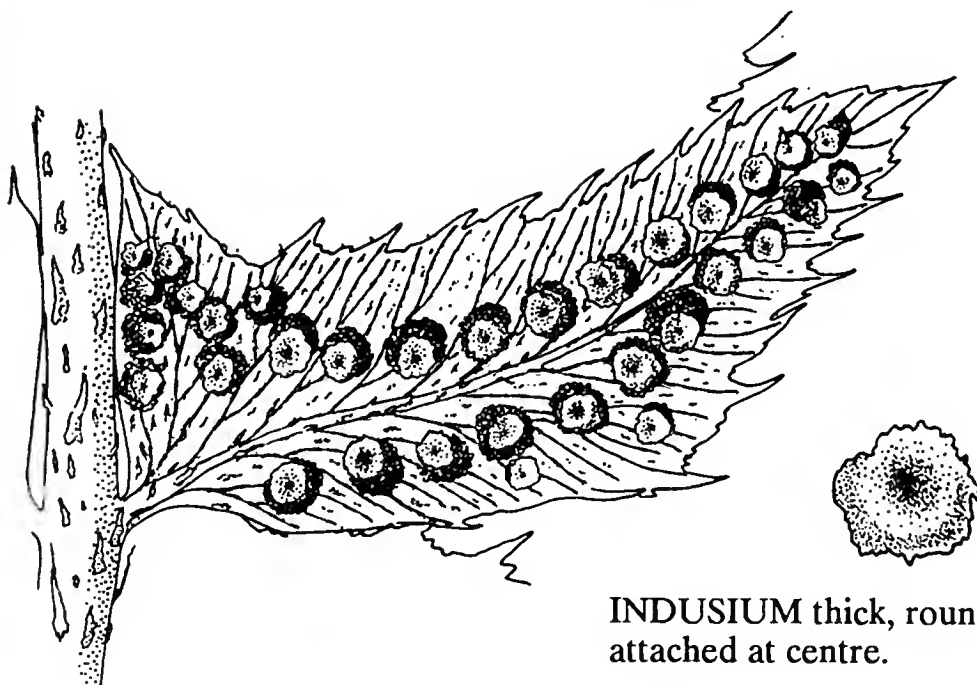
PINNAE close-set or overlapping, lowest pinnae less than 1/2 length of middle pinnae.

STIPE 1/5 - 1/10 leaf length, very scaly.

HABIT: Leaves forming sparse 'shuttlecock' on short, erect rhizome; wintergreen, often living for several seasons.

PINNA margins with obvious, stiff spines.

SORI round, usually in a row either side of the pinna-midrib.



INDUSIUM thick, round, attached at centre.

SPORES c. 40 μ m long, dark brown, papillate (x 400).

HABITAT: Amongst base-rich rocks and scree in high mountains (usually above c. 500 m (1500 ft), occasionally at lower altitudes near western coasts).

DISTRIBUTION: Rare and local in W Ireland, N Wales, N England, more common in Scotland.

CONSERVATION STATUS: Protected in N Ireland under the *Wildlife (NI) Order, 1985*.

COMPARE WITH:

(59) *P. aculeatum*, whose juvenile leaves may be mistaken for this species.

59 Hard Shield Fern
Polystichum aculeatum (L.) Roth

LEAVES 30-90 cm.



LEAF-BLADE narrowly lanceolate, variable in division, 1-pinnate-pinnatisect to 2-pinnate, glossy, deep green, feels stiff when stroked.

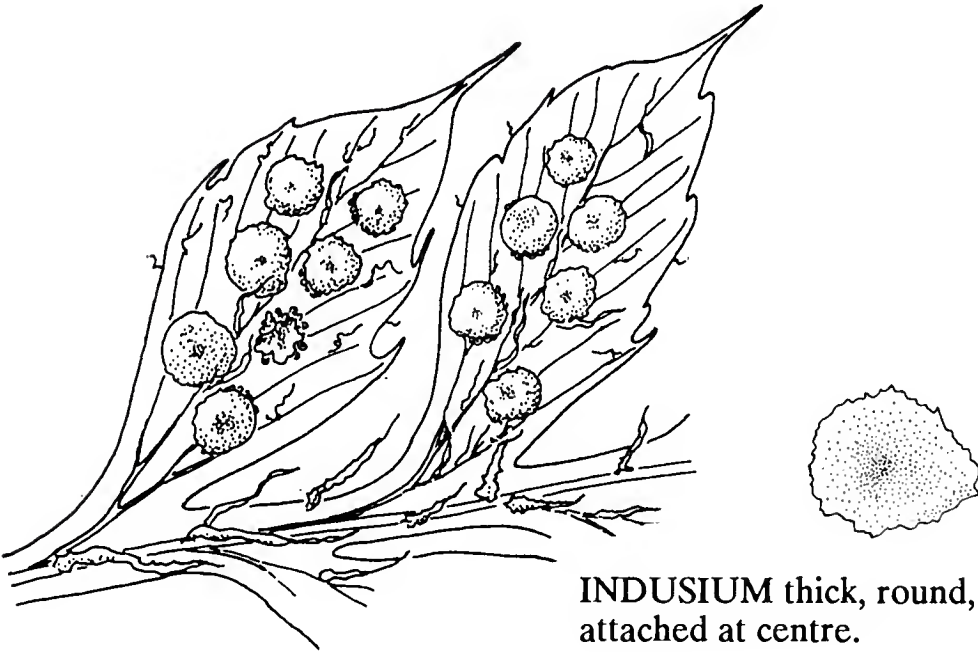
PINNAE spaced, not overlapping, lowest pinna c. $1\frac{1}{2}$ length of middle pinnae.

STIPE usually less than $1\frac{1}{6}$ leaf length, very scaly.

HABIT: Leaves forming 'shuttlecock' on short, erect rhizome; wintergreen.

PINNULES (largest)
usually sessile and
decurrent, tapering to very
acute angle at apex, angle
within pinnule base
usually acute.

SORI round, \pm along
pinnule midrib.



INDUSIUM thick, round,
attached at centre.

SPORES c. 40 μm long,
dark brown, papillate
(x 400).

HABITAT: Mainly upland, in damp, rocky woods and gorges or mountain scree where base-rich rocks occur.

DISTRIBUTION: Throughout the British Isles, but more frequent in N England and Scotland.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(60) ***P. setiferum***, which feels soft, has a longer stipe and the lowest pinnae \pm equal in length to the middle ones.

60 Soft Shield Fern
Polystichum setiferum (Forsk.) Woynar



LEAVES up to 1.5 m or more.

LEAF-BLADE
lanceolate, 2-pinnate,
fairly glossy, bright
green, feels soft when
stroked.

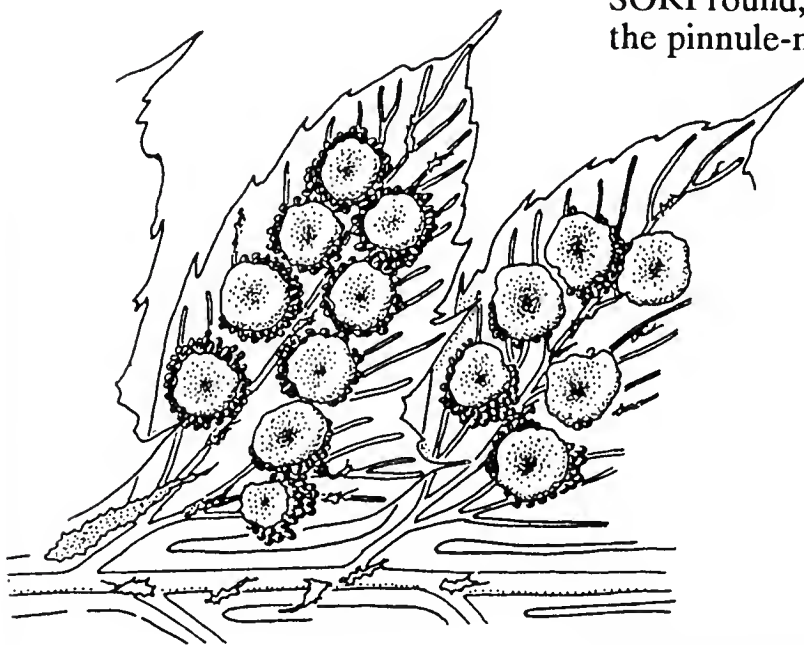
PINNAE well-spaced, not
overlapping, **lowest pinna**
 \pm equal in length to
middle pinnae.

STIPE usually more than
 $1/6$ leaf length, very scaly.

HABIT: Leaves forming 'shuttlecock' on short, erect rhizome;
usually remaining green throughout the winter.

PINNULES (largest)
± stalked, tapering to
obtuse angle at apex, angle
within pinnule base
obtuse.

SORI round, usually close to
the pinnule-midrib.



INDUSIUM thick, round,
attached at centre.

SPORES c. 30 μm long,
yellow, papillate (x 400).

HABITAT: Mainly lowland (up to c. 250 m, 800 ft), in damp sheltered hedge banks and river-valley woods on variable soils.

DISTRIBUTION: Throughout most of the British Isles; very scarce in NE England and Scotland, more frequent in Ireland and SW England.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(59) ***P. aculeatum***, which feels hard, has a shorter stipe and lowest pinnae almost 1/2 as long as the middle pinnae.

61-70 The Male and Buckler Ferns

Dryopteridaceae: *Dryopteris*

Introduction

The British male ferns were originally thought to be just one species, and were called male in contrast to the equally common, but daintier, *Athyrium filix-femina* or lady fern. *Dryopteris* species with more divided fronds have been called 'buckler' ferns through the resemblance of the kidney-shaped indusium to the ancient buckler shield, in contrast to the shield ferns (*Polystichum* species) which have a symmetrical, peltate indusium. Species of *Dryopteris* are typically associated with woodland, areas which were formerly woodland and mountain scree.

The evolutionary history of this genus is very complex, and is not yet fully understood. *D. filix-mas* (62), *D. cristata* (66), *D. carthusiana* (67) and *D. dilatata* (68) have evolved by hybridisation. Only two of the seven diploid ancestors involved, *D. oreades* (61) and *D. expansa* (69), are now found in the British Isles. Another is so far unknown and the rest are restricted in range to areas not glaciated during the Pleistocene. A further species, *D. affinis* (63), is an apomict (see p. 156) and able to produce self-perpetuating varieties and microspecies. A detailed treatment of these is beyond the scope of this book.

Characteristics of Dryopteris

Rhizome apex and stipes covered in scales, sometimes densely so; leaves typically many and arranged in a 'shuttlecock' when the rhizome is erect, but few if the rhizome creeps, 1-pinnate-pinnatisect to 2- or 3-pinnate-pinnatifid; sori in a row either side of midrib of pinna or pinnule segment; indusium kidney-shaped.

Field key to species

- | | | |
|---|---|----------------------|
| 1 | Leaves 1-pinnate, pinnae pinnatisect | 2 |
| 1 | Leaves 2- or 3-pinnate, at least in lower part of leaf | 5 |
| 2 | Stipe 1/3 or more leaf length, lower pinnae very broadly triangular, pinnae of fertile leaf held \pm at right angles to the plane of the leaf | <i>cristata</i> (66) |
| 2 | Stipe 1/3 or less leaf length, pinnae linear to triangular-linear; pinnae of fertile leaf held \pm in the plane of the leaf | 3 |

- 3 Midrib of pinnae dark at junction with rachis, scales dense and golden brown **affinis** (63a-e)
- 3 Midrib of pinnae not dark at junction with rachis, scales sparse and pale brown or straw coloured 4
- 4 Tips of pinnule segments with acute teeth pointing towards segment apex, margins of indusia initially spreading over leaf surface and often overlapping each other **filix-mas** (62)
- 4 Tips of pinnule segments with obtuse teeth diverging from segment apex, margins of indusia always well tucked under and not touching each other **oreades** (61)
- 5 Mature leaves very glandular, especially beneath (x 10) 6
- 5 Mature leaves without glands, young leaves may be sparsely glandular on midribs and veins (x 10) 7
- 6 Leaf triangular-ovate in outline, lowest pinnae 3-pinnate, stipe matt and purplish-brown **aemula** (64)
- 6 Leaf triangular-lanceolate in outline, lowest pinnae 2-pinnate, stipe dull, pale brown **submontana** (65)
- 7 Leaf triangular-ovate to triangular, lower part of leaf 3-pinnate 8
- 7 Leaf linear- or narrowly lanceolate, lower part of leaf 2-pinnate 9
- 8 Pinnule segments not cut to midrib, edges curving downwards; stipe c. 1/3 leaf length; leaves blue-green **dilatata** (68)
- 8 Pinnule segments cut to midrib, flat, edges not curving downwards; stipe c. 1/2 leaf length; leaves mid- to pale green **expansa** (69)
- 9 Margins of pinnule segments with very conspicuous, long, incurving spinulose-tipped teeth that are obvious without a handlens **carthusiana** (67)
- 9 Margins of pinnule segments with short spinulose-tipped teeth that are not striking to the unaided eye 10
- 10 Pinnae in the lower 1/3 of the leaf shortly triangular with the pinna width greater than 1/2 the pinna length **cristata** (66)
- 10 Pinnae in the lower 1/3 of the leaf narrowly triangular with the pinna width much less than 1/2 the pinna length **remota** (70)

61-70 Hybrid Male and Buckler Ferns

The following hybrids (■) have been found in the British Isles:

D. x ambroseae Fraser-Jenkins & Jermy

= (68) *D. dilatata* x (69) *D. expansa*

D. x brathaica Fraser-Jenkins & Reichst.

= (67) *D. carthusiana* x (62) *D. filix-mas*

D. x complexa Fraser-Jenkins nothosp. *complexa*

Fraser-Jenkins

= (63a) *D. affinis* morph. *affinis* x (62) *D. filix-mas*

D. x complexa Fraser-Jenkins nothosp. *contorta*

Fraser-Jenkins

= (63e) *D. affinis* morph. *cambrensis* x (62) *D. filix-mas*

D. x complexa Fraser-Jenkins nothosp. *critica*

Fraser-Jenkins

= (63c) *D. affinis* morph. *borreri* x (62) *D. filix-mas*

D. x deweveri (J. Jansen) J. Jansen & Wachter

= (67) *D. carthusiana* x (68) *D. dilatata*

D. x mantoniae Fraser-Jenkins & Corley

= (62) *D. filix-mas* x (61) *D. oreades*

D. x pseudoabbreviata Jermy

= (64) *D. aemula* x (61) *D. oreades*

D. x sarvelae Fraser-Jenkins & Jermy

= (67) *D. carthusiana* x (69) *D. expansa*

D. x uliginosa (A. Braun ex Döll) O. Kuntze ex Druce

= (67) *D. carthusiana* x (66) *D. cristata*

Some of the hybrids are very rare and have only been found on a few occasions. They are all intermediate in morphology between their parents and can be confirmed by their abortive, shrivelled spores. (NB: Plants of the *D. affinis* complex have a proportion of abortive, shrivelled spores as the norm; their hybrids have a higher proportion of these spores.)

D. x deweveri may be found in some quantity in woods that have become drier and are no longer a suitable habitat for one parent, *D. carthusiana*. This hybrid has a narrower frond outline than the other parent, *D. dilatata*, and the stipe scales have a indistinct, dark, vertical stripe.

												ore
										fmas		■
									aff aff	■		
								aff pal				
							aff bor			■		
						aff rob						
					aff cam					■		
				aem							■	
			sub									
		cri										
	car	■									■	
	dil	■										
exp	■	■										
rem												

61 Mountain Male Fern

Dryopteris oreades Fomin



LEAVES 40-50 (-80) cm, ovate-lanceolate, 1-pinnate-pinnatisect, dull, greyish mid-green.

PINNAE, especially the lower ones, curving forward out of the plane of the leaf, outline uneven, triangular below becoming oblong above.

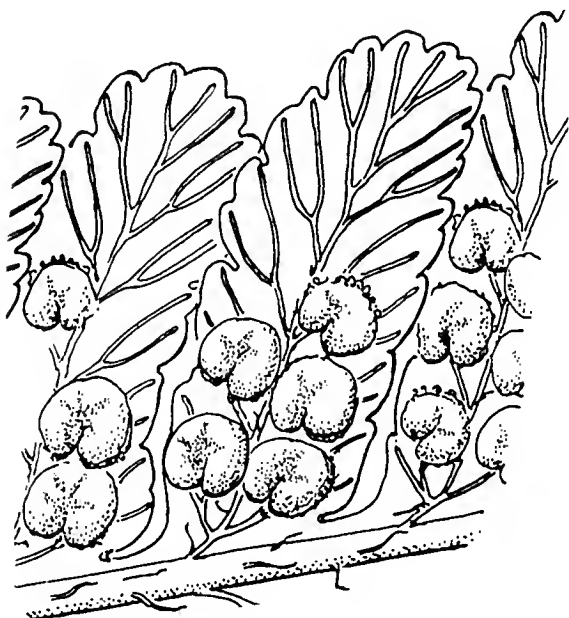
PINNA MIDRIB without dark mark on underside at junction of pinna and rachis.

LOWEST PAIR OF PINNAE \pm symmetrical or asymmetrical, innermost basiscopic segments may be more developed and stalked.

SCALES moderately dense, \pm equal width, apex acute but not hair-pointed, very pale grey-brown.

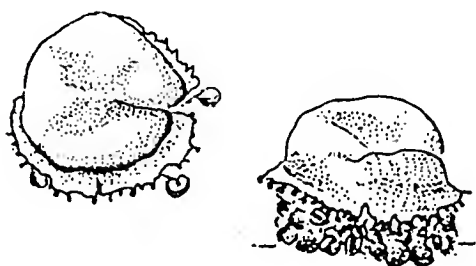
STIPE c. 1/4 or less leaf length, scaly.

HABIT: Plant with erect leaves forming 'shuttlecock' on much-branched, ascending rhizome; dying down in late autumn.



PINNA SEGMENTS
with crisped (turned up)
margins giving a concave
effect, **with blunt lobes at**
sides, teeth at top broad
and divergent.

SORUS c. 1 mm diam.,
typically only on inner
part of pinnules of top
1/3 of leaf.



INDUSIUM \pm thick,
texture granular,
cinnamon coloured at
maturity, margin entire,
usually glandular and
tucked under at first,
maturing to give a
'mob-cap' effect.

HABITAT: A mountain plant (c. 240-610 m, 800-2000 ft),
occurring as scattered groups on well-drained ledges or in stands on
well-drained scree slopes; can descend to lower altitudes on the
colder eastern side of hills or islands.

DISTRIBUTION: Widespread in Scotland, N Britain and Wales;
very rare in Ireland.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

- (62) **D. filix-mas**, which has indusia with flat, spreading
margins, rounded tips to pinnule segments and pinnule
teeth curving towards the apex;
- (63) **D. affinis**, which has a dark mark at the junction of
pinnae and rachis, and usually dark red or golden
brown scales on stipe and rachis.

62 Male Fern

Dryopteris filix-mas (L.) Schott



LEAVES c. 35-150 cm,
ovate-lanceolate,
1-pinnate-pinnatisect,
grey-green.

PINNAE held in plane of
leaf, outline \pm even, linear-
oblong with a short
acuminate apex.

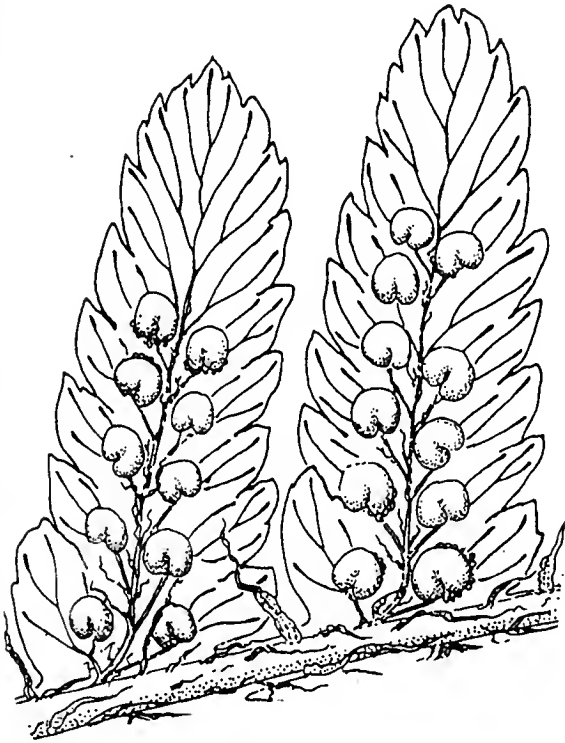
PINNA MIDRIB without
a dark mark on
underside at junction
with rachis.

LOWEST PAIR OF
PINNAE \pm symmetrical or
asymmetrical, innermost
basiscopic segments may be
more developed and stalked.

SCALES moderately dense,
mixture of broad and
narrow, hair-pointed, pale
brown to straw-coloured.

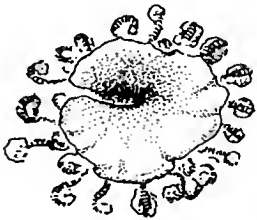
STIPE $1/4 - 1/3$ leaf length,
pale brown, scaly.

HABIT: Plant with leaves forming a 'shuttlecock' on short, erect
rhizome; leaves dying early in winter.



PINNA SEGMENTS with flat or slightly down-curved margins, toothed at edges, tips rounded with acute teeth pointing towards segment apex, no glands on either surface.

SORUS c. 1.5 mm diam., typically over whole of pinnules in top 1/3 of leaf.



INDUSIUM thin, margin entire, initially flattened and spreading, often overlapping each other, shrivelling on maturity to form a 'chanterelle' which is often lost before the spores are shed.

HABITAT: Lowland woods, hedgerows, gardens, scrub and wasteland; in upland to c. 610 m (2000 ft).

DISTRIBUTION: Throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(61) *D. oreades*, which has spreading teeth at apex of pinnule segments and the indusium margin tucked under;

(63) *D. affinis*, which has a dark mark at the junctions of pinnae and rachis and the indusium margin tucked under.

63 Scaly Male Fern

Dryopteris affinis (Lowe) Fraser-Jenkins complex

This 'species' shows a range of morphologies of leaf shape, teeth and lobes of pinna segments, indusium maturation and degrees of scaliness. The five most commonly seen and easily distinguished 'morphotypes' of the span are described on the following pages. Their ancestry is complicated and thought to involve *D. oreades* (61), *D. filix-mas* (62) and *D. affinis* morph. *affinis* (63a). All plants in the *D. affinis* complex are apomictic and have some sterile spores per sporangium (although not as many as in a typical hybrid): each sporangium produces 32 (rather than the usual 64) spores, with each spore containing the same number of chromosomes as the plant producing it (usually the chromosome number is halved); when the spores germinate, a new sporophyte is produced directly from the prothallus without the usual fusion of gametes (antherozoids and egg cell). Thus they are able to produce self-perpetuating varieties and 'micro'-species which, although very limited in distribution, may be locally dominant but almost impossible to assign to one of the morphotypes described here. To complicate matters further, sexual reproduction does occasionally take place and can yield hybrids (see p 150, 151).

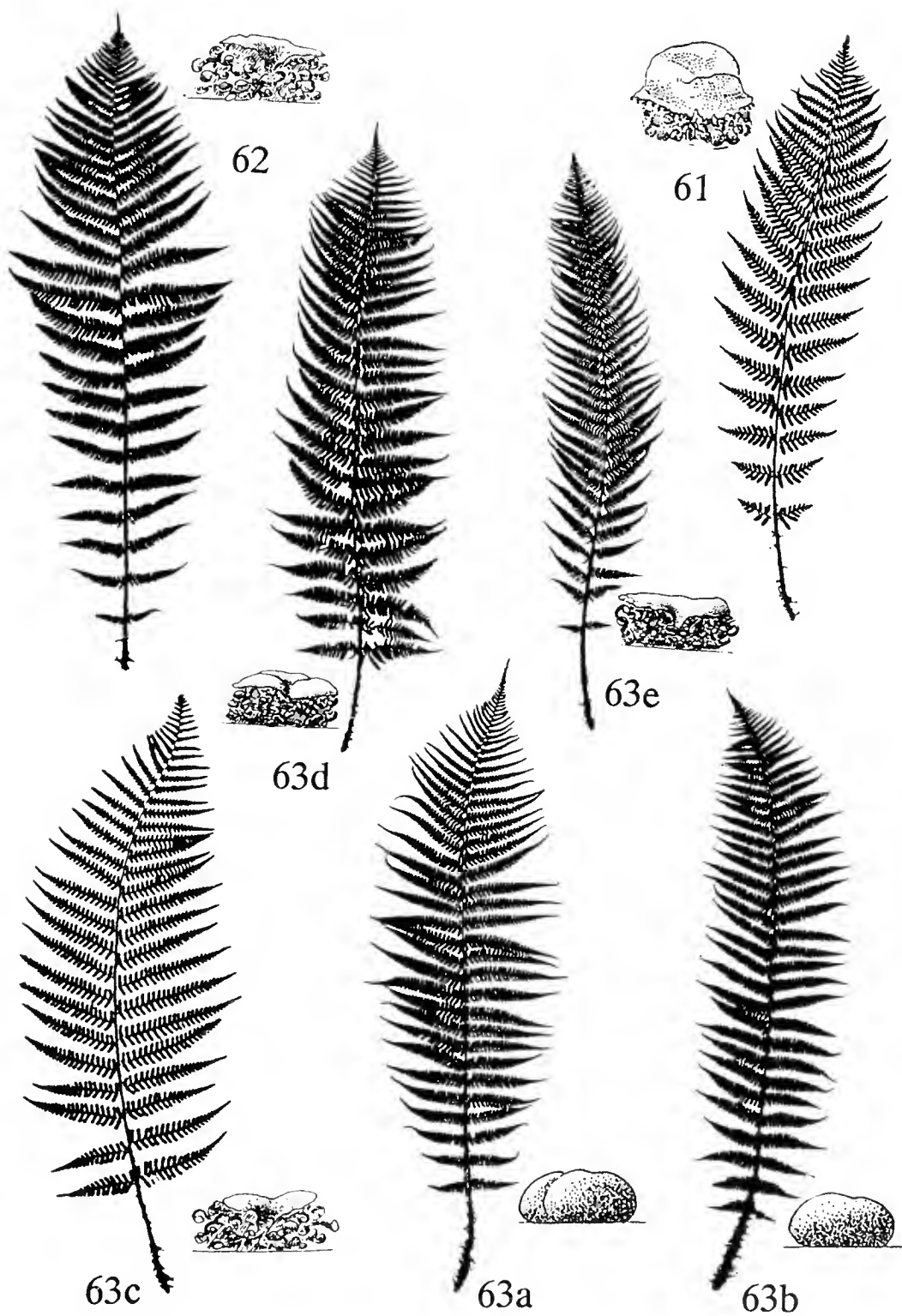
No key is given because overall assessment of characters is necessary to identify a morphotype. Leaf shape (shown opposite), detail and development (mature stage shown in side view opposite) of indusia, the teeth and lobes of the pinna segments and degree of scaliness all need careful evaluation in identifying a specimen.

All morphotypes have indusia with the margin tucked under to enclose the developing sporangia in the youngest stages (as in *D. oreades*, 61). As the sporangia mature, so do the indusia in ways characteristic of the different morphotypes. But not all sori, even on the same pinna segment, develop at the same rate and this is reflected in the variety of form of the indusia seen on any one pinna or leaf. Thickness, especially of the margin, and texture are also important features of the indusium in this group of ferns.

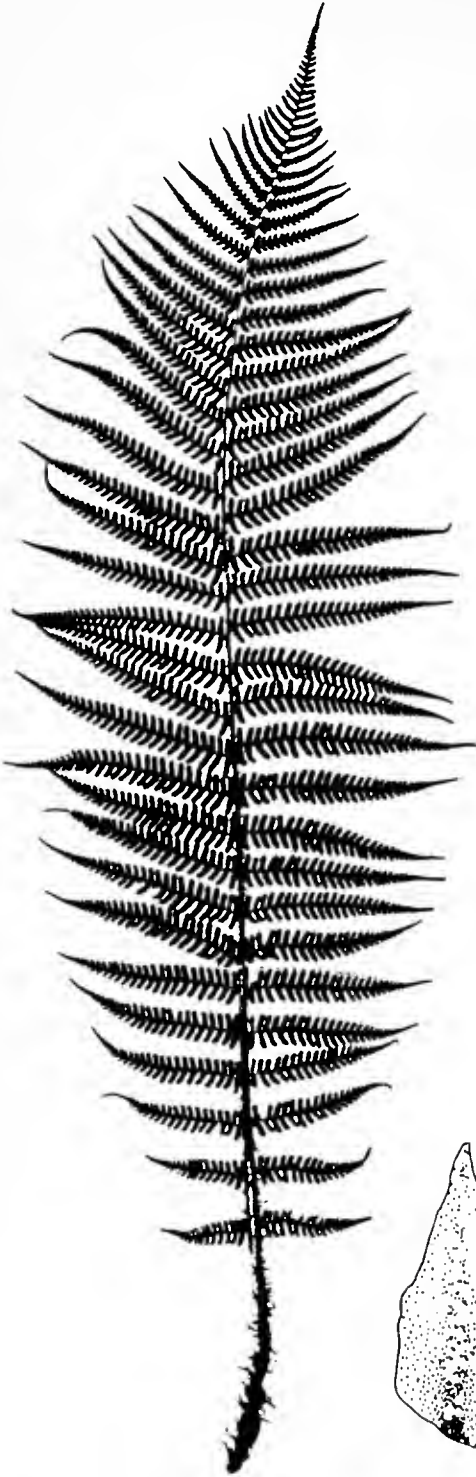
COMPARE WITH:

(61) *D. oreades*, which lacks a conspicuous dark junction of the pinna midrib and rachis;

(62) *D. filix-mas*, which lacks a conspicuous dark junction of the pinna midrib and rachis, and whose indusia of immature sori have the margins lying flat on the lamina surface.



63a Western Scaly Male Fern
Dryopteris affinis (Lowe) Fraser-Jenkins
morphotype *affinis*



LEAVES up to c. 100 (-200) cm, ovate-lanceolate, base \pm tapering, 1-pinnate-pinnatisect, **very firm texture, upper surface of lamina very glossy.**

PINNAE held in plane of leaf, outline even, oblong with long acuminate apex

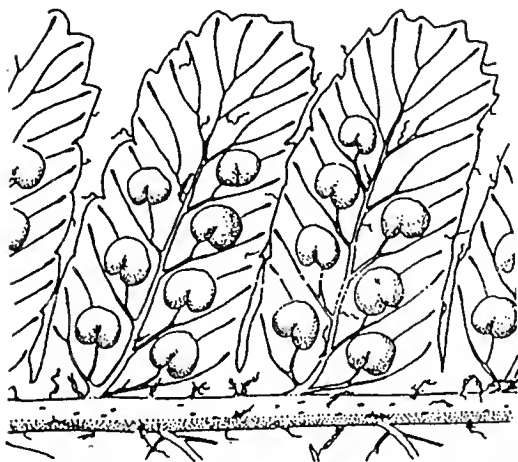
PINNA MIDRIB with dark mark on underside at junction of pinna and rachis.

LOWEST PAIR OF PINNAE \pm symmetrical, with the basiscopic pinna segments beside stipe partially adnate to pinna midrib, i.e. not clearly stalked, and no longer than the corresponding acroscopic pinna segments.

SCALES dark gold, very dense.

STIPE c. $\frac{1}{6}$ - $\frac{1}{5}$ leaf length.

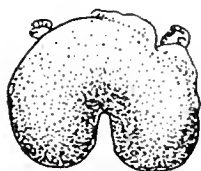
HABIT: Plant with erect leaves forming a 'shuttlecock' on an erect rhizome; remaining green in part throughout winter.



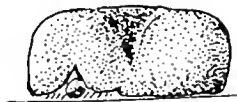
PINNA SEGMENTS
lying flat in plane of
pinna, margins unlobed
or with shallow lobes.



BASAL LOBE of pinna
segments beside rachis
on lowest few pairs of
pinnae often
insignificant, rounded-
rectangular.



INDUSIUM thick,
remaining well tucked-
under as sporangia
mature, lifting slightly
and occasionally
splitting radially on
maturity, persistent
(mostly still present on
last year's leaves) (x 10).



HABITAT: Deciduous woods (and along conifer woodland rides), hedgerows, open hillsides and mountain scree.

DISTRIBUTION: Not completely known; throughout the British Isles but very rare in some eastern counties.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(62) *D. filix-mas*, which lacks a conspicuous dark junction of the pinna midrib and rachis;

(63b, c, d, e) other morphotypes of *D. affinis*.

63b Greater Western Scaly Male Fern

Dryopteris affinis (Lowe) Fraser-Jenkins

morphotype *paleaceo-lobata* (sensu Fraser-Jenkins)



LEAVES up to c. 100 (-200) cm, lanceolate, base \pm tapering, 1-pinnate-pinnatisect, firm texture, upper surface of lamina glossy.

PINNAE held out of plane of frond, outline uneven, oblong with long acuminate apex.

PINNA MIDRIB with dark mark on underside at junction of pinna and rachis.

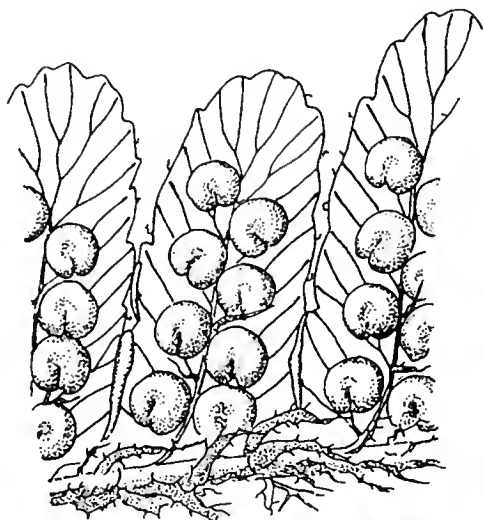
LOWEST PAIR OF PINNAE asymmetrical, with the basiscopic pinna segments beside stipe fully stalked and usually slightly larger than the corresponding acroscopic pinna segments.



SCALES reddish or very dark gold.

STIPE c. $\frac{1}{6}$ - $\frac{1}{5}$ leaf length.

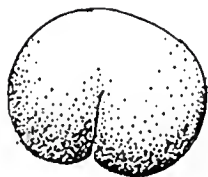
HABIT: Plant with erect leaves forming a 'shuttlecock' on an erect rhizome; remaining green in part throughout winter.



PINNA SEGMENTS twisted out of plane of pinna, margins deeply lobed and slightly curled under, apex rounded-truncate.



BASAL LOBE of pinna segments beside rachis on lowest few pairs of pinnae conspicuous, round to round-rectangular.



INDUSIUM similar to those of (63a), mostly still present on last year's leaves (x 10).

HABITAT: In all types of woodland, hedgerows, open hillsides and mountain scree.

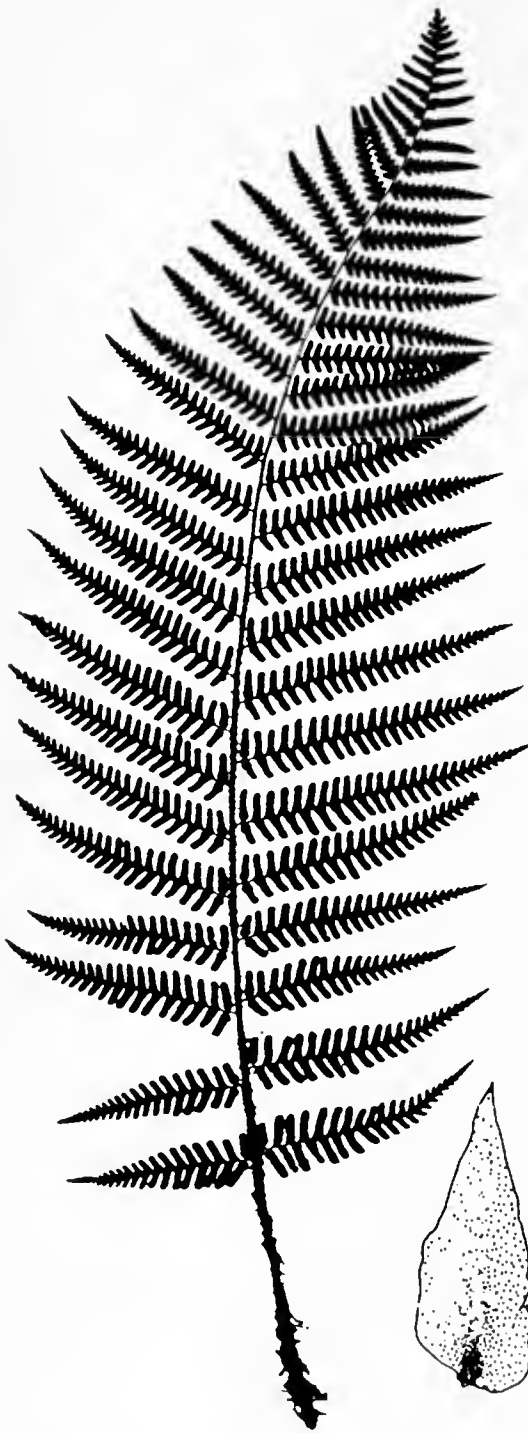
DISTRIBUTION: Similar to morphotype *affinis*, absent from the colder areas in E Britain.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

- (62) *D. filix-mas*, which lacks a conspicuous dark junction of the pinna midrib and rachis;
- (63a, c, d, e) other morphotypes of *D. affinis*.

63c **Borrer's Scaly Male Fern**
Dryopteris affinis (Lowe) Fraser-Jenkins
morphotype *borreri* (sensu Newman)



LEAVES up to c. 100 (-200) cm, lanceolate to oblong, **base truncate**, 1-pinnate-pinnatisect, **texture not very firm**, **upper surface of lamina not glossy**.

PINNAE held in plane of leaf, outline uneven, **oblong with a short acuminate apex**.

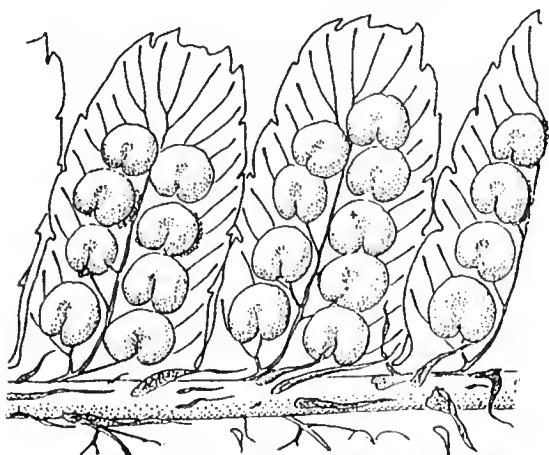
PINNA MIDRIB with dark, but not always very obvious, mark on underside at junction of pinna and rachis.

LOWEST PAIR OF PINNAE asymmetrical, with the basiscopic pinna segments beside stipe fully stalked and slightly larger than the corresponding acroscopic pinna segments.

SCALES only moderately dense, pale gold or brown with dark bases.

STIPE c. 1/5 - 1/4 leaf length.

HABIT: Plant with erect leaves forming a 'shuttlecock' on an erect rhizome; leaves dying early in winter.



PINNA SEGMENTS lying flat in plane of pinna, lateral margins with rectangular lobes, apex variable from squarely-truncate to pointed with sharp, acute teeth usually prominently longer at the corners.



BASAL LOBE of pinna segments beside rachis on lowest few pairs of pinnae sometimes conspicuous and rectangular.



INDUSIUM thin, low, soon lifting to reveal the maturing sporangia, shrivelling and lifting on maturity to form a \pm flat or wavy disc, then later a 'chanterelle' without radial splits, rarely still present on last year's leaves (x 10).

HABITAT: Woods, hedgerows, open hillsides and mountain scree.

DISTRIBUTION: Throughout the British Isles; possibly the commonest form, certainly so in the S and E of Britain.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

(62) *D. filix-mas*, which lacks a conspicuous dark junction of the pinna midrib and rachis;

(63a, b, d, e) other morphotypes of *D. affinis*.

63d Robust Scaly Male Fern

Dryopteris affinis (Lowe) Fraser-Jenkins
morphotype *robusta* (sensu auctt. Brit.)



LEAVES up to c. 100 (-200) cm, lanceolate to ovate-lanceolate, **base truncate** (but less so than 63c), 1-pinnate-pinnatisect, **texture not very firm**, **upper surface of lamina not very glossy**.

PINNAE held in plane of leaf, **outline very uneven**, oblong with an acuminate apex.

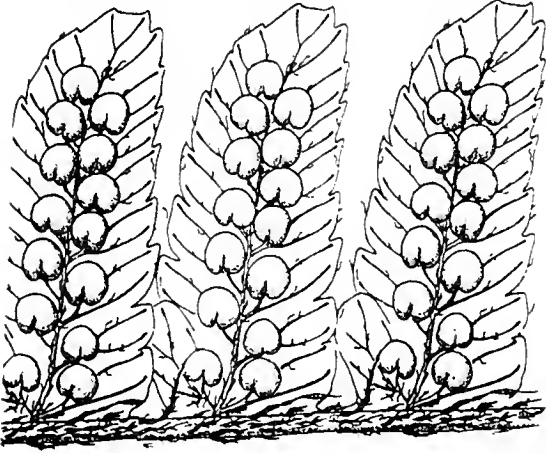
PINNA MIDRIB with a **dark mark on underside at junction of pinna and rachis**.

LOWEST PAIR OF PINNAE very asymmetrical, with the **basiscopic pinna segments beside stipe fully stalked and much larger than the corresponding acroscopic pinna segments**.

SCALES moderately dense to dense, gold with dark bases.

STIPE c. 1/6 - 1/5 leaf length.

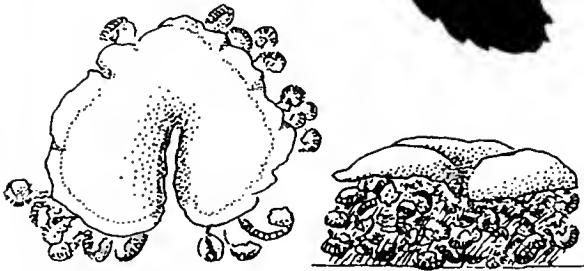
HABIT: Plant with erect leaves forming a 'shuttlecock' on an erect rhizome; leaves dying early in winter.



PINNA SEGMENTS lying flat in the plane of pinnae, margins with deep rectangular lobes, apex oblique-truncate to sharp pointed with acute teeth.



BASAL LOBE of pinna segments beside rachis on lowest few pairs of pinnae conspicuous and rectangular.



INDUSIUM similar in all respects to (63c).

HABITAT: Deciduous woods and rocky gorges, more usually on calcareous rocks or soils.

DISTRIBUTION: Not completely known; widely scattered throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

- (62) *Dryopteris filix-mas*, which lacks a conspicuous dark junction of the pinna midrib and rachis;
- (63a, b, c, e) other morphotypes of *D. affinis*.

63e Narrow Scaly Male Fern

Dryopteris affinis (Lowe) Fraser-Jenkins

morphotype *cambrensis* (sensu Fraser-Jenkins)



LEAVES up to c. 100 (-200) cm, oblanceolate to narrowly elliptical, **base tapering**, 1-pinnate-pinnatisect, **texture firm**, **upper surface of lamina slightly glossy**.

PINNAE held at an angle to plane of leaf, **outline uneven**, oblong to triangular, with a long acuminate apex.

PINNA MIDRIB with a dark mark on underside at junction of pinna and rachis.

LOWEST PAIR OF PINNAE asymmetrical, with the basiscopic pinna segments beside stipe fully stalked and larger than the corresponding acroscopic pinna segments.

SCALES dense, gold to reddish gold.

STIPE c. 1/6 - 1/5 leaf length.

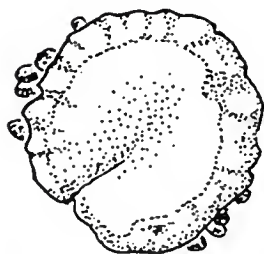
HABIT: Plant with erect leaves forming a 'shuttlecock' on an erect rhizome; leaves dying through winter.



PINNA SEGMENTS lying at an angle to plane of pinna, margins with rounded lobes, slightly curled under, apex rounded-truncate to round-pointed with teeth angled away from apex.



BASAL LOBE of pinna segments beside rachis on lowest few pairs of pinnae conspicuous and round.



INDUSIUM of medium thickness but thin at the edges, rather tall, maturing to form a 'pie-crust', sometimes splitting radially, some still present on last year's leaves (x 10).

HABITAT: Woods, hedgerows, open hillsides and mountain scree.

DISTRIBUTION: Throughout the British Isles; often locally dominant in the west, rare or absent in many eastern areas of Britain.

CONSERVATION STATUS: Not threatened.

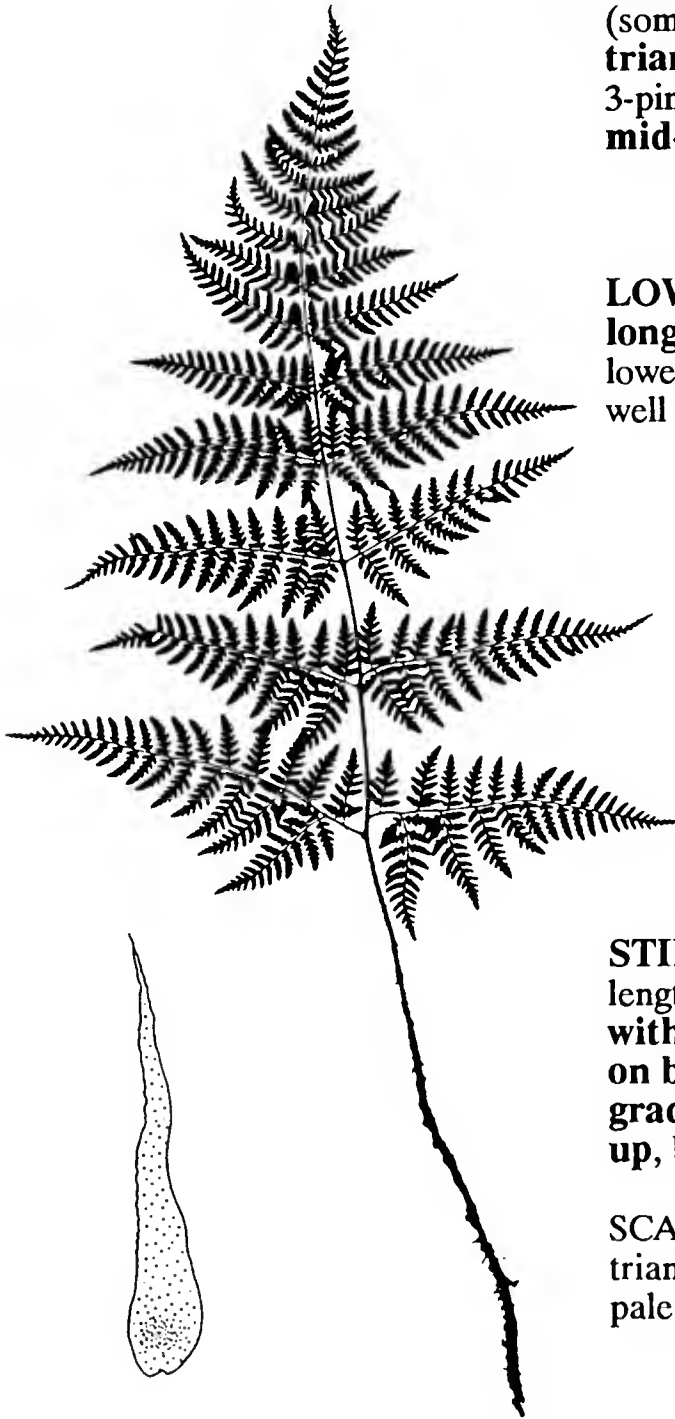
COMPARE WITH:

(62) *D. filix-mas*, which lacks a conspicuous dark junction of the pinna midrib and rachis;

(63a, b, c, d) other morphotypes of *D. affinis*.

64 Hay-scented Buckler Fern

Dryopteris aemula (Aiton) O. Kuntze



LEAVES 15-60 cm (sometimes longer), **triangular-ovate**, 3-pinnate-pinnatifid, **mid-green**.

LOWEST PINNAE the longest, lowermost side of lowest pair of pinnae very well developed.

STIPE \pm equal to blade length, **dark purple-brown** with an **eggshell finish** on both surfaces at base, grading to green higher up, base slender.

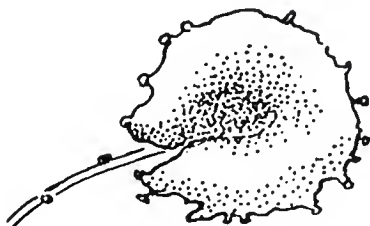
SCALES very narrowly triangular, apex tapering, pale brown.

HABIT: Plant with leaves clustered in loose 'shuttlecock' on short, erect rhizome which has a flat growing-point; leaves tend to stay green over the winter.



PINNULES turning upwards giving a distinct crimped look, minute glands on both surfaces (x 10), giving scent of new-mown hay when crushed or freshly dried.

INDUSIUM with minute glands round the jagged margin (x 10).



HABITAT: A plant of acid woods on granite and other igneous rocks or sandstone; present in heath-bilberry moorland probably as a relict; usually a lowland plant, up to 50 m (150 ft) altitude, but reaching higher altitudes in Ireland where the climate is milder.

DISTRIBUTION: A dominant plant in the SW peninsula of England, the seaboard of W Scotland and W Ireland where the Gulf Stream ameliorates the climate. Its presence in the Weald of Sussex and other isolated sites in cooler areas is maintained by local high humidity.

CONSERVATION STATUS: Not unduly threatened.

COMPARE WITH:

(68) *D. dilatata*, which has a dark, longitudinal, central stripe in the scales and a broadly ovate leaf.

65 Rigid Buckler Fern

Dryopteris submontana (Fraser-Jenkins & Jermy)

Fraser-Jenkins



LEAVES 20-60 cm, triangular-lanceolate, 2-pinnate, **dull grey-green and mealy.**

Innermost pair of pinnules on lowest pair of pinnae \pm equal in length.

STIPE c. 1/2 (or more) leaf length, dull pale brown, very base of stipe enlarged.

SCALES dense, shiny, bright pale brown, long-pointed, glandular, but glands easily lost, mixture of longer, broader and smaller, narrower ones.

HABIT: Plant with leaves forming small groups or loose 'shuttlecocks' on branching, semi-erect rhizomes; growing point domed; leaves dying with first frosts.



PINNULES widely spaced, teeth acute, but not spinulose, **dense yellow glands on both surfaces, fragrant when crushed.**

SORI large, close-packed in 2 rows either side of pinnule midrib.



INDUSIUM margin and surface glandular.

HABITAT: Very rare, in limestone crevices and amongst scree.

DISTRIBUTION: In mountains of N Wales and NW England.

CONSERVATION STATUS: Restricted by fragile habitat.

COMPARE WITH:

No other Buckler Fern is as obviously glandular as this one.

66 Fen Buckler Fern

Dryopteris cristata (L.) A. Gray



LEAVES 30-60 (-100) cm, linear-lanceolate, 1- to 2-pinnate, slightly dimorphic, light green.

STERILE LEAVES with pinnae lying flat in plane of blade, lower pinnae pinnatifid.

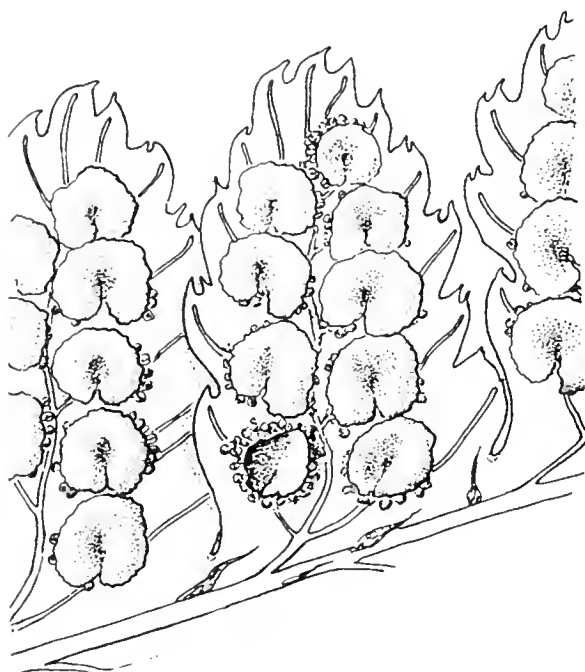
FERTILE LEAVES taller and more erect than sterile leaves, pinnae twisted so as to be almost horizontal, lower pinnae pinnate.

PINNAE, especially lower ones, \pm triangular with pinna width $> 1/2$ pinna length, deeply lobed, apex blunt.

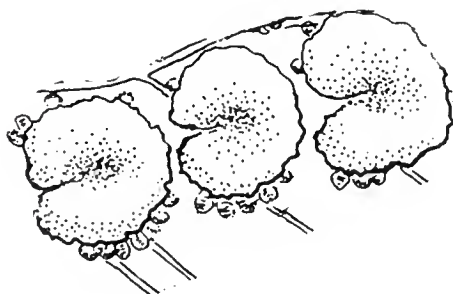
SCALES sparse, uniform pale brown, broad, tapering to an acuminate apex.

STIPE $1/3 - 1/2$ leaf length, pale green-brown, becoming darker at base, very base of stipe enlarged.

HABIT: Plant with few, erect leaves on a creeping, branching rhizome; growing point flat; leaves dying rapidly after frost.



PINNULE SEGMENT
margins with broad,
incurved, short, spinulose-
tipped teeth, no glands on
either surface (x 10).



SORI large, up to 2 mm
diam., borne only in top
1/3 of leaf, almost covering
pinnule segment.

INDUSIUM thin, greenish
and almost translucent until
the spores are ripe, margin
± entire, without glands
(x 25).

HABITAT: Fens, marshes and wet, lowland heaths.

DISTRIBUTION: The Broads of East Anglia, and a few sites in
NW Britain.

CONSERVATION STATUS: Very vulnerable to drainage.

COMPARE WITH:

(67) *D. carthusiana*, which has very conspicuous
spinulose teeth on the margins of the pinna segments.

67 Narrow Buckler Fern

Dryopteris carthusiana (Vill.) H.P. Fuchs



LEAVES 40-80 (-120) cm,
narrowly lanceolate,
2-pinnate-pinnatisect, light
to yellowish green.

PINNAE in lower 1/3 of
frond narrowly triangular.

LOWEST PINNA \pm equal
in length to pinna above.

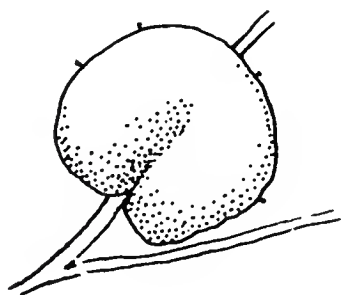
SCALES sparse, pale
brown, \pm concolorous, hair-
pointed.

STIPE c. 1/2 leaf length,
dark brown below, pale
above, very base of stipe
enlarged.

HABIT: Plant with few, erect leaves on a creeping, sometimes branching rhizome, not forming a 'shuttlecock'; growing point flat; leaves dying rapidly after frost.



PINNULE SEGMENT
margins with very
conspicuous long,
incurving, sharp,
spinulose-tipped teeth,
no glands on upper surface,
sometimes some minute
sessile ones underneath.



INDUSIUM margin entire,
wavy or slightly toothed,
sometimes with a few
stalked glands on the margin
(x 25).

HABITAT: In wet woodlands and lowland fens in Britain.

DISTRIBUTION: Locally common.

CONSERVATION STATUS: Sensitive to seral succession and artificial drainage.

COMPARE WITH:

(68) *D. dilatata*, which has scales with a dark central stripe (except those on stolon plants) and a more triangular leaf.

68 Broad Buckler Fern

Dryopteris dilatata (Hoffm.) A. Gray



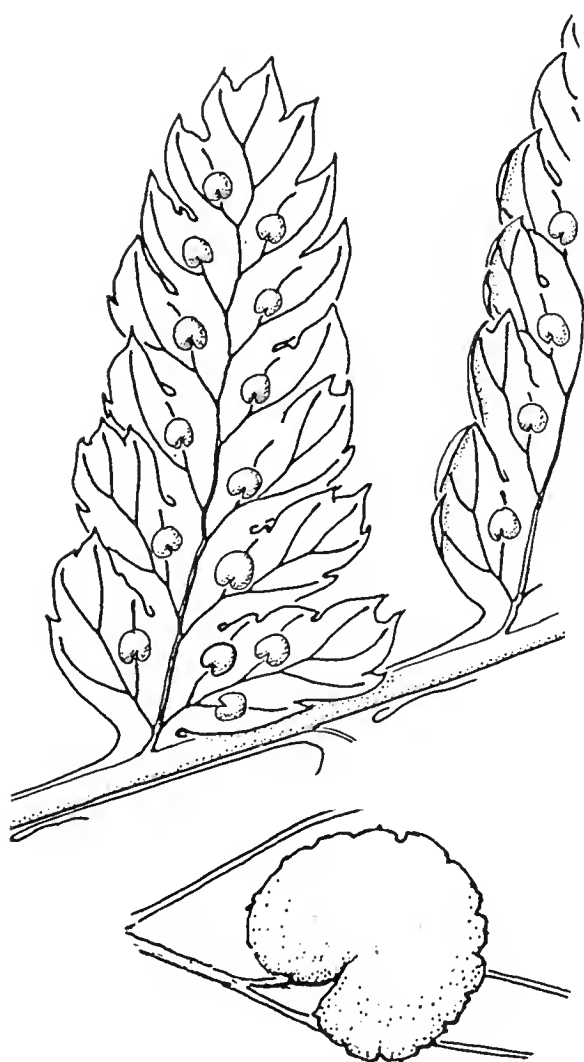
LEAVES 30-150 cm, triangular-ovate, 3-pinnate, **dark, bluish-green**; leaves on stolons may be distinctly triangular.

LOWEST PINNA PAIR with lowermost side well developed.

SCALES sparse, broadly ovate-deltate with long acuminate apex, **dark central longitudinal stripe** (stripe lacking on plants produced on stolons).

STIPE c. 1/3 leaf length, green on upper surface with abrupt transition to red-brown base, lower surface dark and shiny.

HABIT: Plant with leaves arching and clustered in a 'shuttlecock' on a short, \pm erect rhizome; growing point domed; leaves staying green through the early part of winter. Some plants have stolons originating from leaf axils which will be fast growing and creeping until 20-30 cm from parent plant when they become erect.



PINNULES with margins turning under, with short spinulose-tipped teeth, segments not cut to midrib, no glands on either surface (x 10), although midribs can be glandular when young.

INDUSIUM dentate and sometimes glandular (x 25).

SPORES with dense tuberculae, looking darker than those of *D. expansa* (x 400).

HABITAT: In hedgebanks, woods and shady mountain ledges.

DISTRIBUTION: Very common throughout the British Isles.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

- (67) *D. carthusiana*, which has narrower leaves, concolorous scales and a creeping main rhizome;
- (69) *D. expansa*, which is more dissected, has flat pinnule margins and different spores;
- (64) *D. aemula*, which has glands on both surfaces of the pinnae, a triangular leaf in adult plants and a dark purple-brown stipe.

69 Northern Buckler Fern

Dryopteris expansa (C. Presl) Fraser-Jenkins & Jermy



LEAVES 70-80 cm in shady sites and woodland, 10-25 cm on open mountain boulder scree, triangular-ovate to triangular, 2-pinnate-pinnatifid, mid- to pale green, not glandular (x 10) except occasionally on axes when young.

BASISCOPIC PINNULES often much longer than adjacent ones especially on the lowest pinnae.

SCALES dense, broadly ovate-deltate, apex often abruptly acuminate, typically uniform brown-ginger, occasionally with a darker central longitudinal stripe

STIPE up to 1/2 leaf length, brown at base, becoming pale green above.

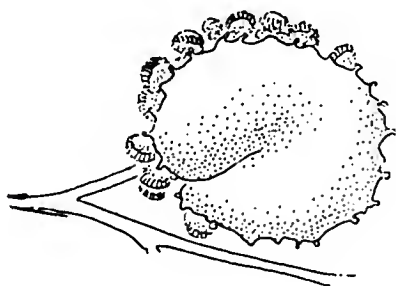
HABIT: Plant with leaves slightly arching and forming a sparse 'shuttlecock' from a \pm erect main rhizome (but see note under *D. dilatata* about plants on stolons); growing point domed; leaves soon dying down in winter except in very sheltered sites.



PINNULES with edges flat in plane of pinnules, no glands on either surface.

PINNULE SEGMENTS more oval, more obviously toothed, and more deeply cut (to midrib) than *D. dilatata*, giving leaf a lacy appearance.

INDUSIUM margin often irregularly dentate, sometimes minutely glandular (x 25).



SPORES with sparse tuberculae, looking paler than those of *D. dilatata* (x 400).

HABITAT: In damp, sheltered crevices in mountain scree, on rocky ledges in ravines and narrow upland valleys; more rarely in lowland woodland in W Scotland.

DISTRIBUTION: Not common. Scattered throughout Scotland, but mainly in the NW, Grampians and S Uplands; N England, in Cheviots, Teesdale and C Lake District; Wales, in Snowdonia and south to Carmarthen; not recorded in Ireland.

CONSERVATION STATUS: Vulnerable to grazing pressure in a few open hill-sites.

COMPARE WITH:

(68) *D. dilatata*, which is darker green, less dissected, and has the pinnule margins deflexed;

(67) *D. carthusiana* (in wet woods), in which the main rhizome is creeping and the scales lack the dark stripe.

70 Scaly Buckler Fern

Dryopteris remota (A. Braun ex Döll) Druce



LEAVES c. 80 cm long, narrowly triangular-lanceolate, 2-pinnate, dark green.

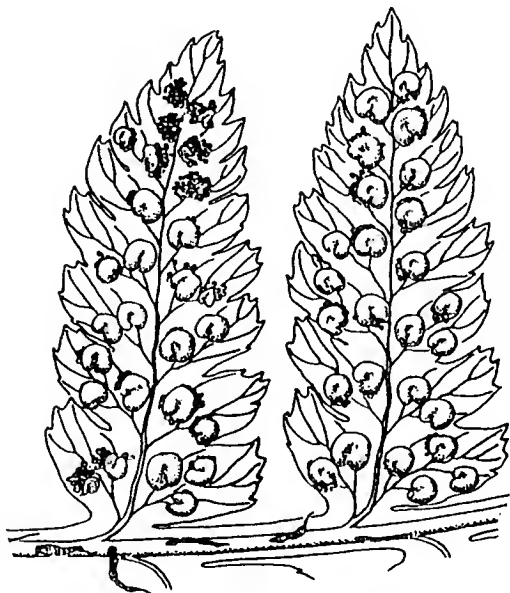
PINNAE narrowly triangular, usually with darkened midrib at junction with rachis.

BASISCOPIC PINNULES of lower pinnae slightly to much longer than corresponding acroscopic ones.

SCALES rather dense, lanceolate-triangular, hair-pointed, pale brown with dark bases.

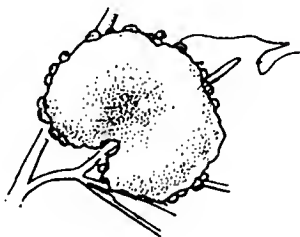
STIPE variable in length, c. 1/3 leaf length.

HABIT: Plant with leaves forming a 'shuttlecock' on short, erect rhizome that forms many crowns; growing point \pm flat; leaves dying early in winter.



PINNULES with sides \pm parallel and with shallow lobes, apex rounded to acute, teeth on sides and apex narrowly acute, no glands on either surface.

INDUSIUM highly convex in the young sorus, shrinking as sporangia ripen and usually persisting when spores have been shed.



SPORES mostly good (but with a fair number of abortive ones) (x 400).

HABITAT: Only circumstantial evidence of the Irish habitats exists; it appears to be a plant of low altitude damp woodland. In mainland Europe it may reach 1200 m (4000 ft).

DISTRIBUTION: Known in the British Isles only from two records in W Ireland, but might be found anywhere that both its postulated parents, *D. affinis* and *D. expansa*, grow or grew.

CONSERVATION STATUS: This species is a triploid apomict of hybrid origin and could be either spontaneously formed anew or perpetuate itself. Very rare, may be extinct.

COMPARE WITH:

Other hybrids between 1- and 2-pinnate species of *Dryopteris*, e.g. *D. x brathaica*, which will have almost totally abortive spores.

The presence of *D. remota* in Ireland where *D. expansa* has not been found is an enigma. The species was said to be growing at Dalystown, Galway and living material was sent to I. Manton in 1935 for cytological investigation. Whilst there is no doubt of its identity, its true provenance must remain uncertain.

71 Hard Fern

Blechnum spicant (L.) Roth



LEAVES 20-65 cm, in sporing plants of two kinds, the fertile leaves with a longer stipe, narrower pinnae and standing erect, the sterile leaves often spreading close to the ground.

LEAF-BLADE narrowly lanceolate to elliptic, tapering to an acute apex and usually more abruptly towards the base, pinnately divided, the pinnae alternate and widely spaced giving a herring-bone appearance, mid- to deep green, young leaves pale green.

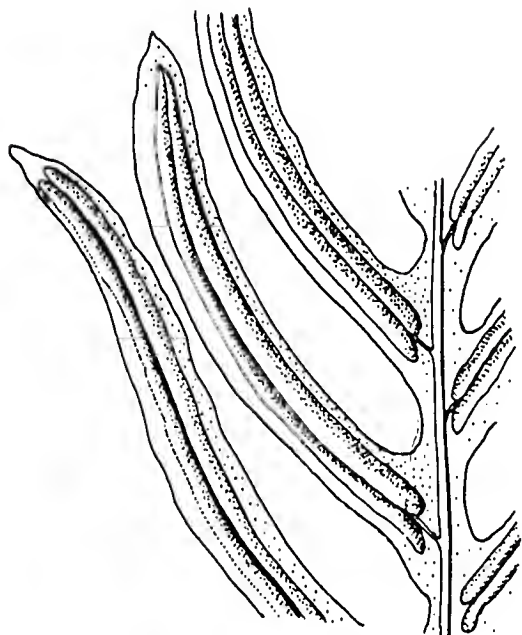
STERILE PINNAE linear or sometimes slightly tapered from the base which is dilated and adnate to the rachis, apex obtuse.

RACHIS glabrous, reddish.

STIPE up to 1/3 leaf length, that of the fertile leaf often longer, purple-brown, scaly at base.

SCALES 5-8 mm long, triangular-lanceolate, tapered to a fine apex, purple-brown.

HABIT: A tufted plant with an erect rhizome often branching to form clumps of several crowns which develop as dense clusters of leaves; wintergreen.



FERTILE PINNAE almost lacking any lamina other than a narrow band that bears the sorus either side of the midrib.

SORUS linear, running the whole length of the pinna, close to the midrib, indusiate.

INDUSIUM linear, turgidly enclosing the entire sorus and only shrinking and exposing the entire sorus at the end of the season.

HABITAT: A marked calcifuge and a common associate of acid woodland on peat and sandy soils, open moorland, lowland heaths and mountain ravines, from sea-level to 1220 m (4000 ft).

DISTRIBUTION: Throughout the British Isles but uncommon in areas with clay soils.

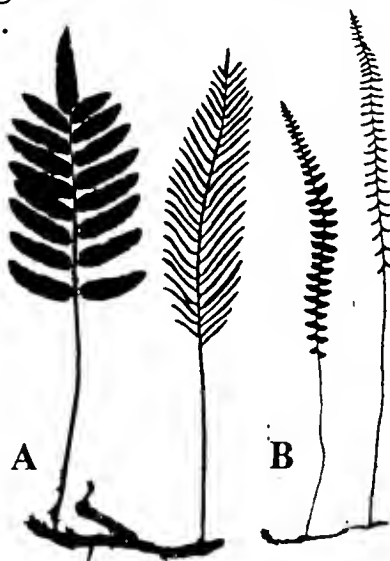
CONSERVATION STATUS: Not threatened.

COMPARE WITH:

There is no other species similar to this in the British flora, but two species of *Blechnum* are grown in gardens and occasionally escape onto hedgebanks and moorland.

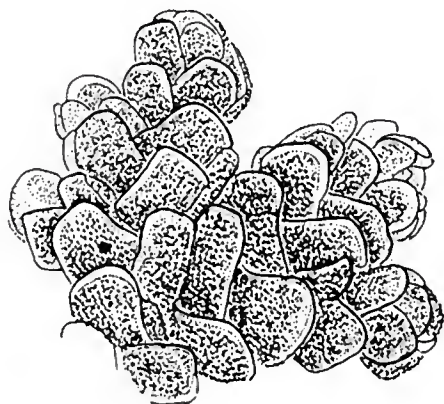
(A) *B. penna-marina* (Poir.) Kuhn (New Zealand) has a similar leaf-form to young *B. spicant*, but it has a vigorous creeping rhizome and much smaller leaves at maturity;

(B) *B. cordatum* (Desv.) Hieron. (Chile) is a much larger, creeping plant with thick, coriaceous leaves, 12 cm or more broad; even sporelings have an ovate leaf which is not decrescent below and would not be confused with *B. spicant*.

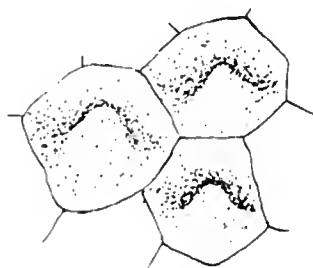


72 Water Fern

Azolla filiculoides Lam.



A distinct and atypical fern in a family by itself (Azollaceae). It is completely free-floating and has a copiously branched, horizontal stem with extremely small leaves.

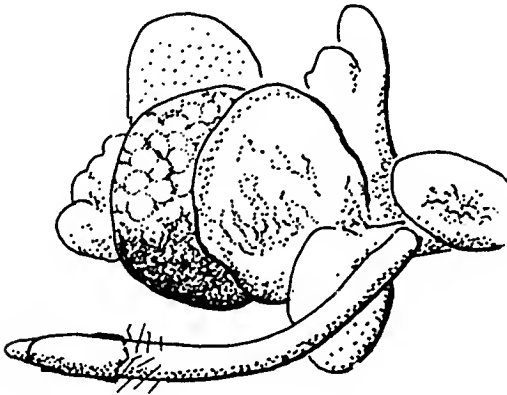


LEAVES sessile, alternate, in two rows on the dorsal side of the stem, bilobed; upper leaf-lobe c. 2.5 x 1-1.5 mm, ovate with an obtuse apex, glaucous green, epidermal cells bearing a single papilla on the outer wall (x 40), the underside with cavities containing the blue-green alga *Anabaena*, (living in symbiosis and able to 'fix' atmospheric nitrogen); the lower leaf-lobe often submerged, colourless.



HABIT: Normally a floating plant forming a dorsi-ventral branched system rooting from the horizontal stem; occasionally terrestrial as open water dries up in summer; leaves turning deep crimson at onset of winter and plants dying back to just small buds which lay dormant or sink to pond bottom until a rise in temperature promotes new growth in spring.

SORUS a globose body known as a **SPOROCARP** which contains either micro- or megasporangia, borne on the first leaf of a lateral branch, the lower leaf-lobe forming the sporocarp and the upper leaf-lobe forming a false indusium covering the sporocarp (x 100).



MICROSPOROCARPS contain numerous sporangia, each containing 64 microspores (x 400).

MEGASPOROCARPS contain only one megasporangium in which a single megaspore develops (x 200).



Both kinds of spores are associated with complex dispersal structures formed from reorganised inner sporangial wall, known as 'massulae', in which the microspores are embedded and bearing barbed, anchor-like outgrowths, *glochidia*; and 'floats', to which the megaspore is attached. These characters are used in species delimitation.

GLOCHIDIA composed of a single cell (i.e. not septate) (x 400).

HABITAT: In ponds and other bodies of still water, ditches, and at the edges of slow-flowing streams amongst riparian vegetation; it can rapidly cover the available water surface to the extent that individual plants may grow over each other.

DISTRIBUTION: Mainly in the south of England, but found as far north as the Isle of Man and Yorkshire; in Ireland in W Cork and Wicklow.

CONSERVATION STATUS: Not threatened.

COMPARE WITH:

Azolla mexicana A. Br. (*A. caroliniana* auct.), another American species has been recorded in W Europe and may be found in the British Isles. It has two papillae on each leaf (upper) epidermal cell and septate glochidia on the massulae.

A1-A6 Alien Ferns and Spikemoss

Introduction

Exotic plants grown in the gardens, conservatories and houses of Britain and Ireland, if they produce propagules of any kind, may spread from time to time beyond the boundaries of the original site of introduction. Depending on their climatic and ecological requirements, their presence in the invaded habitat may be short-lived or of longer duration. The most ephemeral do not even survive the colder days of the following winter. Others may find a niche well-suited to their mode of living and flourish in it for a long time (e.g. *Cyrtomium falcatum* on the shore of St Mary's, Isles of Scilly, first found in 1956, and still there in 1990, in spite of violent storms battering the coast).

We have described, albeit briefly, five species of alien ferns and one spikemoss, accepting a further species, *Azolla filiculoides*, as sufficiently well-established to be included in the main body of the text (as No. 72). These alien species (A1-A6) are those which have been found growing wild in several locations and/or intermittently over a long period of time. There will be others that from time to time establish themselves from spores blown onto a damp wall or that get thrown out with garden rubbish. Two examples of this are mentioned on p. 183: *Blechnum cordatum* (syn.: *B. chilense*) and *B. penna-marina* occasionally escape into moorland areas. Another fern, grown in more clement areas and establishing itself outside gardens as sporelings, is the tree-fern, *Dicksonia*. Possibly two species, *D. antarctica* Labill. and *D. fibrosa* Colenso, are involved. Young plants without a trunk would resemble a *Dryopteris*, but will have hairs, not scales, on the rhizome apex.

Readers wishing to identify cultivated ferns should consult the literature given below. Any well-established pteridophyte that proves to be an alien should be monitored carefully, especially if there is the likelihood of it ousting native species (of any group) from the plant community it has adopted.

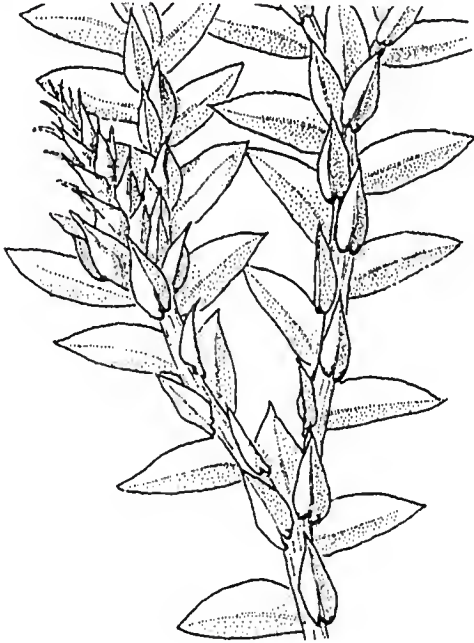
References on exotic ferns

- Jones, D.L. 1987. *Encyclopaedia of Ferns*. British Museum (Natural History), London.
Kaye, R. 1968. *Hardy Ferns*. Faber & Faber, London.
Page, C.N. & Bennell, F.M. 1984. *Pteridophyta* in S.M. Walters *et al.* *The European Garden Flora*. University Press, Cambridge.
Rush, R. 1984. *A Guide to Hardy Ferns*. Brit. Pteridological Soc., London.

Krauss's Spikemoss

Selaginella kraussiana (G. Kunze) A. Braun

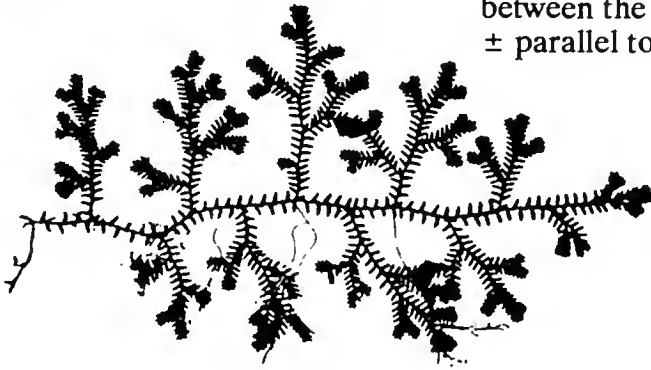
A1



FERTILE LEAVES and SPORES
as in (7) *S. selaginoides*, but
forming cones 7-12 mm long on
side branches.

A prostrate plant with slender, branched and intertwined stems rooting frequently at branch intersections. If well-established and sheltered can form a mat, but usually fragmented due to die-back in winter.

This species is in the much larger, and mainly tropical, section of the genus which has **LEAVES of two kinds: lateral leaves, 1.5-2.5 mm**, asymmetrical, \pm linear-oblong, lying in one plane \pm at right-angles to the stem, opposite or diametrically opposed, well-spaced on main stem, closer, often touching on branches; **median leaves** (best seen on branches, those on main stem not obviously smaller than lateral leaves), **0.5-1 mm**, ovate-lanceolate, drawn to an acute tip, lying centrally between the larger leaves and \pm parallel to the stem.



HABITAT: Hedgebanks, roadsides and amongst low vegetation, usually not far from habitation and point of introduction.

DISTRIBUTION: Now established quite extensively in more clement lowland areas in W Britain and in Ireland; native to the Azores, Madeira, tropical and S Africa, and grown as a conservatory plant for ground-cover.

COMPARE WITH:

No other similar species in the British flora.

A2 Ladder Brake

Pteris vittata L.

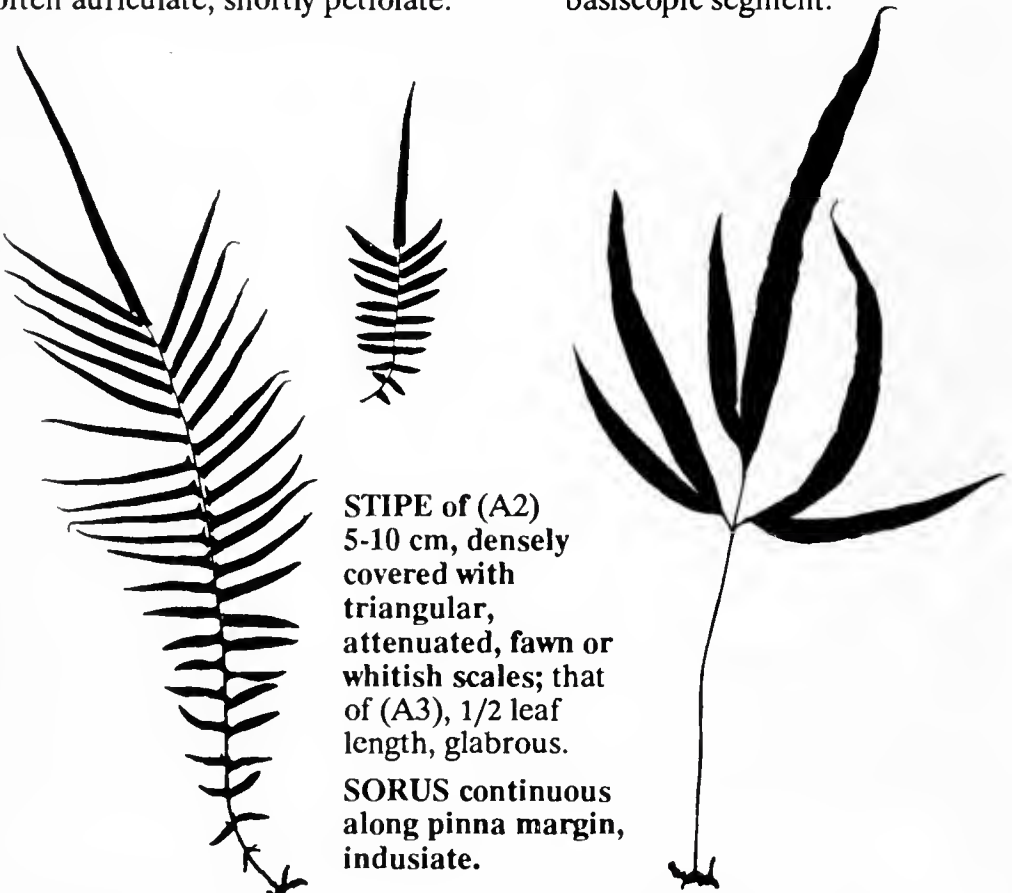
A3 Cretan Brake

Pteris cretica L.

Both species have few leaves arising from a short-creeping rhizome. LEAVES of both are from 10 cm (in depauperate specimens on walls) to 40 (-70) cm long, **pinnate, with the apical pinna longer and larger than lateral pinnae (clearly seen, even in very young specimens).**

PINNAE of (A2) < 7 cm, 10-25 pairs, narrowly triangular to linear, finely serrate, the base often auriculate, shortly petiolate.

PINNAE of (A3) 15 cm or more, 1-5 pairs, strap-like, the lowest with an extended basiscopic segment.



HABITAT: Cultivated as house plants, they establish themselves in rocky (including man-made) habitats where a frost-free climate exists, e.g. outhouse walls, wells and sunken culverts, and colliery slag heaps.

DISTRIBUTION: Occasionally in the south and along the western seaboard of Britain; a large colony of (A2) established itself on a disused coal tip in W Gloucestershire in 1964, but not seen there recently, the habitat now cooled and overgrown.

COMPARE WITH:

(32-34) *Polypodium* species (especially cultivars) can superficially be similar when growing on dry walls, but the absence of an apical pinna much larger and longer than the lateral ones, the adnate pinnae and position of sori clears any doubts.

Chinese Holly Fern

Cyrtomium falcatum (L. fil.) C. Presl

A4



Plant with an erect, densely scaly rhizome with an open cluster of leaves up to 60 cm (or more in lush situations, but much smaller when in dry habitats.)

LEAF-BLADE linear-oblong to ovate-lanceolate, pinnate, leathery, glossy, deep green.

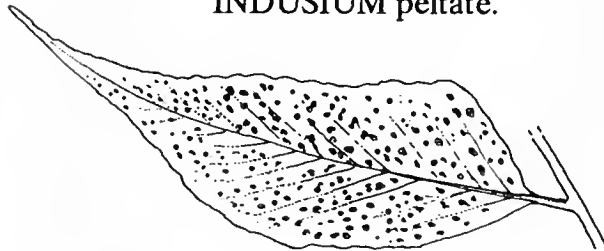
PINNAE up to 6 cm long, ovate-linear, irregularly toothed, apex acuminate, falcate, terminal pinna often tripartite or diamond-shaped.

STIPE, $1/5-1/3$ leaf length, green, scaly.

SCALES 6-10 mm long, ovate, golden to dark brown.

SORI discrete, circular, scattered, indusiate.

INDUSIUM peltate.



HABITAT: A plant that likes to wedge its rhizome between rocks, in moist exposed places, hedgebanks etc.

DISTRIBUTION: A native of E Asia, grown as a pot plant and in conservatories in the British Isles; established in the Scilly and Channel Isles, and occasionally on warm, moist walls in towns in S and SW Britain.

COMPARE WITH:

Although young plants are similar to **Polystichum** species, the fewer, broader, net-veined pinnae, and distinct terminal pinna separate this species.

A5 Sensitive Fern

Onoclea sensibilis L.



Plant with a thick (6-12 mm) far-creeping, branching rhizome with leaves arising at intervals; dying down in autumn.

LEAVES of two kinds: sterile leaves 40-70 cm long, triangular-ovate, pinnate at base, pinnatisect above, at first reddish becoming vivid green; **fertile leaves shorter than sterile, lamina \pm lacking, red-brown, becoming brown and persisting through the winter.**

PINNAE 5-8 pairs, 7-16 cm long, elliptic, margin entire or wavy at leaf apex to deeply lobed below, basal pinnae stalked; veins anastomosing.

STIPE $\frac{2}{5}$ leaf length, glabrous, stramineous, red-brown at base.

SORUS round, 1-2 at base of each lobe covered by inrolled apex, the whole a purplish colour, hardening and persisting through the winter.

INDUSIUM membranous, soon lost.

SPORES green, shed the following spring.

HABITAT: Wet lake margins and areas where ground water seeps. Frequently grown in gardens where it quickly spreads.

DISTRIBUTION: In damp woodland and marshy meadows mostly in southern and western Britain and in Ireland; a few well-established populations exist in Cumbria some distance from an obvious source of introduction; a North American species.

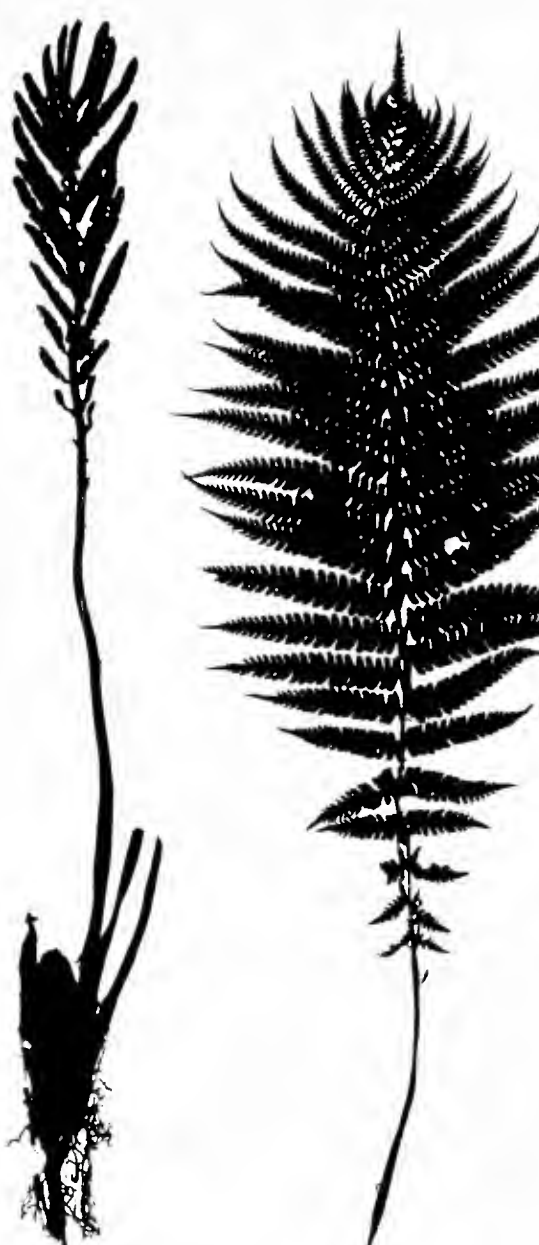
COMPARE WITH:

Even in the vegetative state the leaf-shape and rhizome of this species can be easily identified. However, young leaves of this species and (24) *Osmunda regalis* can be very similar in shape and texture, but *Osmunda* has free, not reticulate, veins.

Ostrich Fern

Matteuccia struthiopteris (L.) Tod.

A6



Plants with an erect rhizome, forming large and attractive 'shuttlecocks' but also bearing long-creeping stolons at the end of which new plants arise.

LEAVES of two kinds: the sterile up to 140 cm long, the fertile often half that length, lacking green lamina tissue.

LEAF-BLADE oblanceolate, pinnate-pinnatisect, a rich, fresh green, not glandular.

PINNAE up to 15 cm long, the lower pairs markedly decrescent, lobes linear-oblong, apex bluntly rounded or truncate.

STIPE $\frac{1}{4}$ length of sterile leaf, $< \frac{1}{2}$ that of fertile leaf, glabrous, base spatulate.

SORUS round, 1-2 at base of each lobe covered by inrolled apex, the whole a purplish colour, hardening and persisting through the winter.

INDUSIUM membranous, soon lost.

SPORES green, shed following spring.

HABITAT: In wet woods on heavy clay soils; prefers water percolating through its roots.

DISTRIBUTION: Scattered throughout the British Isles; widely grown as an ornamental, but easily escapes by means of its stolons which can be over 10 m long; native of N America and N Europe.

COMPARE WITH:

(38) *Oreopteris limbosperma* which is very glandular and bears sori on leaves with green lamina tissue.

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Figures given mostly refer to species numbers; page numbers are given for taxa only referred to in discussion. Synonyms are given in italics.

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Written by two experts on the staff of the Botany department at The Natural History Museum, London, *The Illustrated Field Guide to Ferns and Allied Plants of the British Isles* is a definitive account of the species of ferns and allied plants encountered in Britain and Ireland.

The guide gives keys to and descriptions of all native species and a number of aliens that may be found. The salient diagnostic points are clearly listed against line drawings made by Peter Edwards (pteridologist at the herbarium of the Royal Botanic Gardens, Kew). Notes on habitat requirements, distribution, conservation status, and species with which each can be confused, and lists of the hybrids found in each genus are given.

The guide has been compiled with both the serious student and the general natural historian in mind, and beginners in botany will find the work invaluable.

Other Fern Titles From Natural History Museum Publications

A World of Ferns

J. Camus, C. Jermy & B. Thomas

Encyclopaedia of Ferns (UK sales only)

D.L. Jones

